SEPTEMBER 21, 1935

THE LANCET

Offices: 7, ADAM STREET, ADELPHI, W.C.2.

Telegrams: LANCET, RAND, LONDON. Telephone: TEMPLE BAR 7228 and 7229.

No. XII. OF VOL. II., 1935. LONDON, SATURDAY, SEPTEMBER 21, 1935 Pp. 112—Price 1s.
No. 5847. VOL. CCXXIX. Founded 1823. PUBLISHED WEEKLY. Registered as a Newspaper. Annual Subscription: Inland £2 2s. Abroad £2 10s.

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No. 5847 LONDON, SATURDAY, SEPTEMBER 21, 1935 CCXXIX

CONTENTS

THE WHOLE OF THE LITERARY MATTER IN THE LANCET IS COPYRIGHT

ADDRESSES AND ORIGINAL ARTICLES

Respiratory and Vascular Changes in the Mammal before and after Birth. By Sir JOSEPH BARCROFT, F.R.S.—(*Illustrated*) 647

Combined Distance Radiation of Hypopharyngeal Cancer. By STANFORD CADE, F.R.C.S., and F. M. ALLCHIN, M.B., D.M.R.E. —(*Illustrated*) 652

Treatment of Low-calcium Tetany with Calciferol. By R. S. STACEY, B.Chir. —(*Illustrated*) 656

Azotæmia in Acute Bright's Disease. By J. B. RENNIE, M.D. — (*Illustrated*) 658

Amount of Hæmoglobin in the Blood. By E. R. HOLIDAY, B.M., PHYLLIS M. TOOKEY KERRIDGE, M.R.C.S., and F. C. SMITH, M.R.C.S.—(*Illustrated*) 661

Old "Laboratory" Strains of the Polymorphic Trypanosomes. By H. LYNDHURST DUKE, M.D. 665

CLINICAL AND LABORATORY NOTES

Tuberculosis of the Nasal Sinuses Treated by Irradiation. By W. A. TROUP, M.D. 667

Free Melanin-Bearing Cells in Ascitic Fluid in Diffuse Melanomatosis. By W. R. SNODGRASS, M.D. 668

REVIEWS AND NOTICES OF BOOKS

Disorders of the Blood. By Lionel E. H. Whitby, F.R.C.P., and C. J. C. Britton, M.D. 669

Radiological Atlas of Chronic Rheumatic Arthritis (Hand). By S. Gilbert Scott, M.R.C.S., D.M.R.E. 669

Chronic Nasal Sinusitis and its Relation to Mental Disorder. By F. A. Pickworth, M.B. 669

The Osteopathic Lesion. By G. Macdonald, M.B., and W. Hargrave-Wilson, D.O. 670

The American Illustrated Medical Dictionary. By W. A. Newman Dorland, M.D., and E. C. L. Miller, M.D. 670

LEADING ARTICLES

A HOSPITAL INSURANCE SYSTEM 671

THE 'CARE OF THE MENTALLY DEFECTIVE 672

PERSONALITY AND AGE .. 672

ANNOTATIONS

Pleural and Pulmonary Sepsis 674

Accidents and the Mortality of Young Adults 674

The Radium Beam 675

Toxic Action of Volatile Solvents 675

Practical Lessons from Irradiation of Bodo Caudatus 675

A French Sanatorium Village 676

Rebuilding Programme .. 677

Treatment of Syphilis during Pregnancy 677

PROGNOSIS

LXIX.—Prognosis in Jejunal Ulcer. By R. P. PICTON DAVIES, M.R.C.P. 678

SPECIAL ARTICLES

Plaster Technique in the Modern Treatment of Fractures. By K. H. PRIDIE, F.R.C.S.—Pt. I. (*Illustrated*) 680

Mental Care in 1934: Board of Control Report 685

Medicine and the Law: Alleged Masquerading under Doctor's Name.—Sequel to Sydney "Shark Arm Case" 687

Paris: Tetanus Immunisation—A Sanatorium for French Students—Laboratory Assistants 687

Ireland: The Task of the Hospitals Commission—The late Dr. J. T. Elliott 688

Opening of the Medical Schools: Charing Cross —Guy's—King's College —London— Middlesex— —Royal Free—St. Bartholomew's—St. George's — St. Mary's — St. Thomas's — University College —Westminster— Royal Dental..... 690

Infectious Disease in England and Wales.... 692

CORRESPONDENCE

Vaccination on the Third Day (Dr. Donald Paterson) 691

Perforation of the Œsophagus by a Swallowed Foreign Body (Mr. N. Asherson, F.R.C.S.).... 691

Bacteriology of Rheumatism (Prof. K. Douglas Wilkinson, F.R.C.P.) .. 691

Malaria and Racial Extinction (Dr. A. J. Copeland) 691

Biliary Drainage (Dr. D. Lincoln Lewis)..... 692

PANEL AND CONTRACT PRACTICE

The Drug Habit—Tuberculosis in Wales.—Surgical Spirit..... 689

THE SERVICES

Royal Naval Medical Service.—Royal Army Medical Corps.—Royal Air Force 679

MEDICAL NEWS

King's College Hospital... 692

An Anglo-Scandinavian Pilgrimage 677

Fellowship of Medicine and Post-Graduate Medical Association 679

Cheshire Hospitals 687

Llanelly Hospital 688

Society of Apothecaries... 692

Society for the Study of Inebriety 692

Society of Public Analysts 692

Wireless Sets for Hospitals 692

British Red Cross Society.. 692

Charing Cross Hospital ... 693

Royal Eye Hospital..... 693

Food Poisoning at Swansea 693

Leeds Public Dispensary and Hospital 693

Mental Health Congress... 693

Durham County Hospital 696

NOTES, COMMENTS, AND ABSTRACTS

A Proposed National Oxygen Tent Service... 694

Regius Chair of Physic at Cambridge 694

Some Hospital Pharmacopœias..... 695

Child Development..... 695

Doctors, Chemists, and Population 696

Hygienic Caps for Milk Bottles 696

Medical Diary 693

Births, Marriages, Deaths 693

Appointments 696

Vacancies 696

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RESPIRATORY AND VASCULAR CHANGES IN THE MAMMAL BEFORE AND AFTER BIRTH *

BY SIR JOSEPH BARCROFT, C.B.E., F.R.S.
FELLOW OF KING'S COLLEGE, CAMBRIDGE, AND PROFESSOR OF PHYSIOLOGY IN THE UNIVERSITY

THE object of my lecture is to give you, in so far as I can, some consecutive idea of the respiratory and vascular changes which occur in the fœtus during birth. As a preliminary, therefore, I must say something about the life led by the fœtus; I must further make it clear that the information which I have been able to procure mostly from experiments on sheep has been elicited from Cæsarean sections.

Imagine then that there is in front of you a bath of such a size that it will contain the body of a sheep or goat, while the head projects from it and is supported by the back of the bath. The sheep is under an anæsthetic, which in most of my experiments has been urethane, but in some the animal has been rendered insensitive to pain by the injection of starch grains into the carotid artery—a procedure which was shown by Prof. Langley (1923) to be the equivalent of removal of the higher centres. The abdomen is in the bath and is immersed in saline solution; it is opened and the uterus exposed; the uterus is then opened and the fœtus withdrawn. The fœtus is now lying entirely immersed in saline at about 100° F., but with its circulation unimpaired and of course attached to the placenta by the cord. Perhaps the first thing which strikes you is that the fœtus is flaccid and movement only occasionally takes place, the second is the strength of the pulse in the cord, the pulsation being easily visible owing to the movement of the cord produced by each heart beat.

The strength of the circulation in the cord prompts the question: how much blood does the fœtal circulation contain? Another question follows closely upon the heels of that one: what proportion of the blood is in the fœtus and what proportion in the placenta?

Blood Volume

The fœtal blood volume has been fully investigated by Elliott, Hall, and Huggett (1934), who found that, relatively to the weight of the fœtus itself, the blood volume was very large in the early stages of fœtal life and, though increasing absolutely, its ratio to the fœtal weight became progressively smaller as time went on. At birth the fœtal circulation might contain for a kid of about 3 kilos. 500 c.cm. of blood. The gist then of the work of Elliott, Hall, and Huggett was that at birth the quantity of blood in the fœtal circulation, including the placenta, was about 15 per cent. of the weight of the fœtus, and that after birth the mass of circulating blood bore the same relation to the weight of the kid. If this be true one of two things must follow: (1) either the quantity of blood in the placenta and cord is negligible, or (2) the blood from the placenta is collected into the fœtus at birth.

In sheep I have made some observations to ascertain what proportion of the whole fœtal blood was actually in the fœtus and what proportion in the placenta and cord with the results shown in Table I.

We are left then with a picture of the fœtal circulation as divided into that of the fœtus itself and that of the cord and placenta. The former contains one-half to three-quarters of the blood, the latter from one-quarter to one-half. We have reason too to suppose that the blood from the placenta, or most of it, is withdrawn into the fœtus at birth. This

TABLE I

Serial number of sheep.	Fœtal age in days. (Period of gestation about 150 days.)	Percentage of fœtal blood.	
		In fœtus.	In placenta and cord.
6	84	57	49
7	96	48	52
11	111	66	34
19	137	73	27

point will arise later. The reason why the blood volume becomes proportionately smaller as the fœtus grows is that the fœtal circulation includes not only the fœtus itself but the fœtal vessels in the placenta. The placenta does not grow pari passu with the fœtus but before it, and therefore in the earlier stages of pregnancy the placental circulation forms a much greater proportion of the whole fœtal vascular bed than it does later on. It would be an exaggeration to say that a small fœtus consisted functionally principally of a heart which pumped blood through the placenta, but the exaggeration would be no greater than that legitimately allowed to the caricaturist who produces a more telling likeness than the realist.

Blood Pressure

It is necessary to distinguish clearly between the quantity of blood which is actually in the placenta at a given time and the quantity which irrigates it. The former is the measure of the vascular bed for the time being, the latter depends not only upon the bed but also upon the pressure with which the blood is driven through the placenta, that is the pressure in the umbilical artery. This is probably not very different from that in the carotid artery, and therefore the data given in Table II. may be taken as typical.

TABLE II

Serial number of sheep.	Fœtal age in days.	Artery.	Pressure mm. Hg.
12	49	Umbilical.	20
50	101	Carotid.	34
39	120	,,	46
15	123	,,	50
19	137	,,	72
27	138	,,	68
28	140	,,	76

In the last six weeks or so of pregnancy the arterial pressure of the fœtal sheep more than doubles; this in itself will make a great difference to the amount of blood which circulates through the placenta. Yet even so, up to birth the fœtus is essentially an organism with a low arterial pressure; in the operation of birth the pressure rises by 20 mm. of mercury, so that in the newly born lamb it has a value of about 95–100 mm. of mercury. Could we reverse the process and go back from the lamb to the fœtus, we should say that the fœtus had gone into a state of collapse.

In this connexion, and perhaps at the risk of forestalling some points which must arise later, we can discuss the annexed tracing (Fig. 1). It reads from left to right;

* The John Mallet Purser memorial lecture, given at Trinity College, Dublin, on June 25th, 1935.

at the commencement it is a tracing of the arterial pressure of a sheep's fœtus approaching term, in fact 138 days old. At the end it is the blood-pressure tracing of a lamb newly born, and therefore the period which it covers, amounting to about five minutes, includes the whole operation of birth by Cæsarean section. I may justify the word birth by saying that the lamb lived a number of days in the laboratory fed by the bottle. At the commencement of the tracing the arterial pressure is about 63 mm. of mercury. At the point X the cord is tied; there is some rise of pressure which does not last, and the first breath (the breaths are indicated by arrows) took place 48 seconds after the cord was tied. Each breath is of the nature of a gasp or spasm, and is frequently associated with a general rise of blood pressure, but this rise of pressure is not maintained, and it is not till nearly five minutes after tying the cord that the organism can be considered as definitely launched; after that the blood pressure is maintained and the respirations become frequent and regular. Thus, remembering that in the last resort the two may be mutually dependent, we have separated the events of birth into two categories, the respiratory and the vascular.

The First Respiration

What is the cause of the first respiration? This takes place as the result of clamping the cord, but after a long delay. Three possible causes may be assigned as the one responsible for the first breath:—

(1) Oxygen want.
(2) CO_2 excess.
(3) Increased blood pressure in the brain.

The last seems an unlikely cause, but it demands more than a passing thought because, even before the first respiration, another phenomenon is apparent on the blood-pressure tracing—namely, a marked slowing of the heart. This is a feature, not only of fœtal asphyxia, but also of post-natal asphyxia and is attributed by Anrep's school to increased arterial pressure. But the first breath does not appear to be due to increased pressure, because it sometimes takes place in the absence of hypertension and sometimes as in the present case after the hypertension has passed off.

If excess of carbonic acid were the cause, it should be easy without occluding the cord to produce the breath by giving the mother mixtures of oxygen with large quantities of CO_2 to breathe. We have never been able to produce respiration in this way; indeed, the fœtus seems singularly unresponsive to CO_2 administered by this method.

oxygen which it contains postpone the first breath. This phenomenon can be produced with perfect regularity.

Fig. 2 shows three portions of the same tracing. In the uppermost (A), in which the whole cord was occluded, 41 seconds elapsed before the first breath took place; in the middle tracing (B), in which the arteries only were

FIG. 2.—Three portions of a similar tracing showing effect of pinching—
(A) the whole cord, arteries, and veins,
(B) the arteries only,
(C) and subsequently the whole cord.
At X the vessels are pinched and at Y they are released.
† = breaths.

pinched, 57 seconds elapsed; while in the lowest one (C), in which the whole cord was blocked, 49 seconds elapsed. The middle tracing presents some points which indicate that blood from the placenta did actually find its way into the fœtus in quantity sufficient to affect the record. The immediate rise in fœtal arterial pressure consequent on the occlusion was much more marked and more sustained when the arteries only were occluded, and, a minute or so after the vessels were released, the middle tracing shows that the pressure became depressed to an extent which it did not in the first and last. Again, note that this depression was associated with intense slowing of the heart, which makes it difficult to argue that even the slowing of the heart was due to rise of blood pressure rather than to limitation of the oxygen supply of the brain.

(*b*) If the first breath is due to want of oxygen, it would be satisfactory to produce the anoxæmia in some way which caused no upset to the circulation. Ordinarily such a method would be the administration of carbon monoxide: this standard method is not available in the present case because the carbon

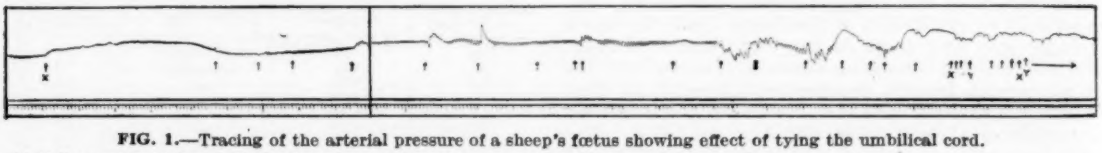

FIG. 1.—Tracing of the arterial pressure of a sheep's fœtus showing effect of tying the umbilical cord.
At X the cord is tied and at Y released. † = breaths. → = breathing continued regularly.
The tracing is continuous except that, at the black line, one minute has been cut out in which nothing of moment happened.

That lack of oxygen may lead to respiration we have positive evidence.

(*a*) Other things being equal, the more blood the fœtus has in its body the greater will be its store of available oxygen and the longer should be the interval of time between occlusion of the cord and the first respiration. I have already shown that perhaps a quarter or a half of the blood is in the placental circulation. Advantage may be taken of this fact. If instead of pinching the whole cord the umbilical arteries only are pinched, leaving the umbilical veins free, the blood from the placenta, or a portion of it, should drain into the fœtus and in virtue of the

monoxide must needs be given to the mother and this, for several quite obvious reasons, would be unsuitable. We determined on the more heroic course of cutting down the oxygen content of the blood, by turning a portion of the fœtal hæmoglobin into methæmoglobin; this we did both by the injection of hydroxylamine chloride and of potassium ferricyanide, drugs which have little in common except their property of producing methæmoglobin.

Thus in a certain experiment (Sheep 39) in which the fœtus was quiescent but showed the usual phenomena on pinching of the cord, and in which pinching of one only of the two arteries failed to produce respiration, the

injection into the umbilical vein of 65 mg. of hydroxylamine chloride in 2·5 c.cm. of saline produced respiration in 40 seconds. (Incidentally there was only a trifling rise in blood pressure and no slowing of the heart.) The effect passed off after a time, and a second injection was given which brought on respiration more rapidly and persistently.

Now it is clear that if this effect of hydroxylamine is due to the conversion of a portion of the fœtal hæmoglobin into methæmoglobin, the respiratory movements which it produces should be abolished by the injection of blood into the fœtal circulation. This in fact takes place. In the experiment just described, after the second injection of hydroxylamine had done its work and the respiratory movements had been established in a spasmodic way, 45 c.cm. of blood were transferred from the jugular vein of the mother to the fœtal circulation, with the result of immediately abolishing the spasms and bringing back the fœtus to approximately its original condition. And this alternation may be repeated. The proof, then, that the first respiration is due to depriving the fœtus brain of its oxygen-supply seems pretty clear.

I would enter one caveat here, and while I regard oxygen-want as the essential cause of the first breath, I am not prepared to say that the quantity of carbonic acid in the fœtal blood has no effect either in its magnitude or in the degree of oxygen-want necessary to cause it.

Before leaving the subject of the first breath let me say a word about its nature. I have spoken of it as a breath, but that quite inadequately describes it for it is a gasp, involving a great proportion of the muscles of the body. It may be questioned, indeed, whether the fact of air being introduced into the chest is much more than incidental. I mean that a general wave of contraction passes over a great part of the musculature of the body and since the diaphragm and intercostal muscles are powerful muscles the chest is opened. This gasp in fact seems to resemble in every possible way the dying gasp of an animal subjected to oxygen-want, say by cyanide poisoning or even deprivation of oxygen in the air; this is true in some detail, even to the order in which the muscles contract. From the point of view of the fœtus, the gasp is an index pointing, not to life, but to death, and we are faced with the remarkable paradox that the dying gasp of the fœtus is the earnest of life to the individual.

Slowing of the Heart

This remarkable phenomenon is so constant an effect of pinching the cord that it seems impossible to pass it over without taking a moment to consider its significance. When first I saw it, the idea struck me that it might have to do with the opening of the lung vessels that slow pulsations of large amplitude might, as it were, strike more effectively at the door and aid in opening up the vascular bed in the lungs more efficiently than would a rapid shallow pulse. That may or may not be so, but I do not think it is the important point.

Clearly there is hope for the fœtus to be born so long as the heart can beat. On what factors does the margin of time depend, between the cutting off of the placental supplies and the death of heart, in the event of birth not taking place? The heart presumably has at its disposal a certain amount of energy stored in some form or other, and can go on beating till this is exhausted. The energy which it uses in a given time is presumably a function of the initial tension at each beat multiplied by the number of beats; but in practice, as the initial tension does not vary very much, the energy at the disposal of the heart becomes exhausted proportionately to the number of beats which it gives. In other words, the heart can go into debt, oxygen debt or some other kind of debt, to the extent of a definite number of beats—say a thousand—so, clearly, the more slowly it beats consistently with preserving the blood pressure, the longer it postpones the inevitable end, should there be any difficulty in the establishment of the new respiratory and vascular conditions.

Course of Fœtal Circulation

One of the most obvious differences between the fœtus and the mother is that the former derives its oxygen from the placenta and the latter from the lungs. This change involves a fundamental alteration in the circulation. In the fœtus the blood which arrives at the heart may be divided into two categories. One portion comes along the inferior vena cava and consists of blood from the placenta and the lower part of the body. The second portion consists of blood coming from the head, the arms, the upper part of the trunk, and the coronary system. Let us first make an effort to discover what is the total volume of blood which passes through the fœtal heart per minute, and then we will pass to the consideration of the proportions in which these two main sources contribute to the whole.

The quantity of blood which passes through the fœtal heart per minute can be measured by a plethysmographic method. The great dangers of such a method are two: the first is lest it should give an incorrect measurement of the quantity of blood actually traversing the heart; the second, and perhaps the greatest, is lest the plethysmograph should restrict the blood flow. The present method was therefore calibrated in small animals against the blood flow as measured in other ways, and appears to give results too low by about 15 per cent. In calculating, the addition of 15 per cent. has been made to the figures as measured. The measurements gave singularly uniform results—namely, that, from the earliest date at which they were obtained until term, the volume of blood which traverses the heart is 0·15 c.cm. $\pm$0·03 of blood per minute for each gramme of the body-weight of the fœtus. These results were obtained in goats. They tend rather to increase as the fœtus grows older, but not outside the limits stated. It will be asked: how does this value compare with the quantity of blood which goes through the heart after birth? In fact the two are about the same. In making this statement I mean that the quantity of blood which traverses the fœtal heart is the same as that which traverses both ventricles after birth, and is therefore the double of what is ordinarily known as the minute volume—i.e., the volume of blood driven round the body per minute.

As regards the course of the stream, the information at our disposal comes chiefly from the researches of the anatomists. The classical picture they give is of relatively red blood arriving at the heart via the inferior vena cava, crossing directly through the foramen ovale to the left auricle, passing thence to the left ventricle, and so along the aortic arch and carotid arteries to the head. The dark blood from the jugular vein, brachial veins, azygos vein, coronary veins, &c., goes through the right auricle to the right ventricle and so along the pulmonary artery; such of it as gets to the body passes along the ductus arteriosus arriving in the aorta distally to the exit of the redder blood which goes to the coronary system, the head, the arms, &c.

It was naturally a matter of some interest to me to test the truth of the deductions made from an inspection of structure. The oxygen present in the blood at various fœtal ages and in various localities

can be tested—not only so, but by studying both the composition of the confluents which form a given stream and that of the stream itself, the proportions in which the confluents mix can be determined. It is not necessary here to give all the details; summarised they amount to this:—

(1) The blood which passes through the heart may be regarded as forming two streams approximately equal in volume.

(2) One of these goes to the "head" and is not much inferior in its oxygen content to the redder blood which reaches the heart—namely, that coming along the inferior vena cava.

(3) The second, which is not much redder than the venous blood from the "head," goes to the "body," which means the lower part of the trunk and the placenta.

(4) Of the blood going to the "body," about two-thirds goes to the placenta.

The crossing therefore is nearly complete, almost every corpuscle which arrives from the placenta at the heart goes thence to the upper circulation, unloads oxygen in the head, the heart, the arms, &c., and then, traversing the heart again, goes up the ductus arteriosus and either unloads more oxygen, in fact most of its residual oxygen, in the body or goes to the placenta, there to receive another load.

This picture warrants a moment's thought, for, while it justifies the anatomical description, it seems to carry with it some implications which are not very easy. In the first place, on this showing, three times as much blood goes to the "head" as to the body. Can this be so? In order to find out the limits of the localities to which blood could go without passing down the abdominal aorta, the aorta was ligatured in fœtal guinea-pigs just proximally to the entry of the ductus arteriosus, a cannula was inserted into the left ventricle which was still beating and blue fluid was injected. As well as the actual head and arms, the whole of the chest wall was injected, and, what was very interesting, the coverings of the spinal cord down almost to the lumbar swelling. Thus all the organs which at this stage of fœtal life are functionally important, except the liver and the lowest section of the cord, can receive reddish blood from the upper circulation.

Now a word about the liver. It occupies a most remarkable place in the circulation which is very little stressed. The liver receives blood direct from the placenta—the purest which any organ receives—and therefore has a first option on whatever comes. In some animals, indeed—e.g., the horse, which is described as having no ductus venosus—the whole of the blood arriving from the placenta is poured into the portal vein and must traverse the capillaries of the liver before reaching the fœtal heart. Thus the liver of the fœtus is in as strong a position as that of the normal animal to receive and deal with everything that is necessary for the metabolic activity of the animal, all the products of absorption of foodstuffs as they diffuse through the placenta, as well as the necessary oxygen.

These considerations still further reduce the number of the important organs which are supplied with what may be called second-hand blood.

The Ductus Arteriosus

Another implication is as follows: if something like a third to a half of the blood leaving the heart traverses the ductus arteriosus, that vessel is one of the main arteries of the body and is in no sense an accessory or vestigial structure. Is it large enough to discharge this responsibility? If the ductus arteriosus is only capable of allowing the passage of 10 or 20 c.cm. of blood per minute, the picture which I have drawn is clearly an impossible one. Perfusion of the ductus arteriosus, however, shows that even in the cold and dead condition, when perfused at the pressure of the pulmonary artery, something like 120 c.cm. of blood per minute can pass along it. This is not quite the requisite amount, but it is of the right order.

I used the phrase "the pressure in the pulmonary artery." Here again is an implication, that the pressure on the right side of the fœtal heart must be much the same as on the left—namely, about 70 mm. Hg towards the end of fœtal life. Certainly the structure of the heart is not inconsistent with this conception, for at birth the thickness of the ventricle wall is approximately the same on the right and left sides. Therefore while the endocardiac pressure on the left side of the heart increases after birth that on the right side falls away to about 18 or 20 mm. of mercury—one-quarter of its fœtal value.

Here, however, is a more difficult question; if the efficiency of the fœtal circulation depends so completely upon the passage of a large quantity of blood along the ductus arteriosus, and the efficiency of the circulation after birth depends so completely upon the occlusion of the ductus arteriosus, it is rather difficult to visualise this closing as anything but a sudden process, either mechanical, such as a valve, or functional, such as a muscular spasm.

In this connexion the structure of the ductus arteriosus is interesting. It seems singular that its histology should differ materially from that of the arteries to which it is attached, yet that is the fact, for while the pulmonary artery and the aorta are highly elastic at birth, the ductus arteriosus resembles a small peripheral artery in its structure. The elastic elements are proportionately much less conspicuous and the muscular elements—or what seem to be muscular elements—are much more conspicuous than in the aorta or pulmonary artery. For the present, the closure of the ductus arteriosus must be left for further investigations which we have undertaken.

Respiration Before and After Birth

Without going into a detailed description of the events which take place in the placenta, suffice it to say that the oxygen passes from the maternal to the fœtal blood, so far as is known, by a process of diffusion. This process is greatly facilitated by the fact that fœtal blood has a considerably greater affinity for oxygen than the maternal blood. There are numerous ways in which such a result might be brought about. Perhaps the most obvious would be if the hydrogen-ion concentrations of the two bloods were different, and indeed it is true that the maternal blood during pregnancy is less alkaline than usual, a fact which tends to expel the oxygen from the hæmoglobin of the mother. But it is of the essence of the membrane which separates the blood of the mother from that of the fœtus that it should admit of the freest possible diffusion and therefore it cannot support any great difference of hydrogen-ion concentration on its two sides. It seems that the fœtus possesses a hæmoglobin of a different type from that of the mother, a hæmoglobin with a higher affinity for oxygen; this is true of the goat, the sheep, and the rabbit. The hæmoglobin of the chick also has a greater affinity for oxygen than that of the hen, and I believe even the tadpole's blood pigment differs in a similar way from that of the frog (Barcroft, J., 1935). Man at first sight presents the solitary exception, for the hæmoglobin of the human fœtus and even

of the new-born child has a less affinity for oxygen than that of its mother, but this anomaly is set right when the hæmoglobin is not in solution but in corpuscles. We do not know what the essential difference between the pigment inside and outside the corpuscle may be, but, whatever it is, the effect of packing the hæmoglobin into the corpuscles is such that the pigment of the mother loses its affinity for oxygen to a much greater extent than that of the fœtus, and thus it happens that in the same buffer solution and at the same temperature the fœtal corpuscles in man, as in other forms, have a greater affinity for oxygen than those of the mother.

The relevant question is: at what stage does the fœtal hæmoglobin disappear and the post-natal hæmoglobin take its place? In the sheep this is almost exactly at birth. Up to the 138th day of fœtal life at all events there is no perceptible change. By the time the lamb is 39 days old the change appears to be complete, and even five days after birth it has gone a long way. Perhaps, however, the most remarkable thing about the transition is its nature. The affinity for oxygen is of course expressed by the oxygen dissociation curve, and it might be supposed that, given the pre-natal and post-natal types, the transitional type would lie between them so that it would be possible by mixing X c.cm. of typically embryonic blood with Y c.cm. of typically post-natal blood to get a blood the hæmoglobin of which gave an intermediate curve. This is not what takes place; the dissociation curve of the hæmoglobin derived from the blood at birth has a curve which is less inflected than that of either the pre-natal hæmoglobin or the post-natal hæmoglobin. Here again the chemical significance is not discovered. On the whole it looks as though the most likely explanation were not the right one and that the pre-natal pigment broke down in some way and was re-formed into the post-natal type.

From the point of view of function it must be borne in mind that, if the fœtal hæmoglobin has a greater affinity for oxygen than the post-natal type and so picks up the gas with ease in the placenta, reciprocally it gives up its oxygen with corresponding difficulty in the tissues. Is there any danger of the fœtus being asphyxiated because the hæmoglobin will not part sufficiently readily with its oxygen? This brings us to the question: does the fœtus use as much oxygen per gramme of tissue as the born animal? The coefficient of oxidation—to use the phrase invented by Chauveau and Kaufmann (1887) to express the number of cubic centimetres of oxygen used per gramme per minute—is known pretty accurately for goats at rest to be on the average 0·0085 c.cm. For kids in the first three days of life we have made a number of observations which varied from 0·005 c.cm. in a kid of 20 hours which had not been fed to 0·01 c.cm. ±0·001 during the first week of life. This figure is in contrast to the metabolism of the fœtus. This is not easy to measure, and any measurement depends upon certain assumptions. The determination was first made by Zuntz and Cohnstein (1884), who did experiments upon sheep with results which varied greatly; their highest was 0·0025 c.cm. per gramme per minute.

We have done six experiments on goats and about the same number on sheep, and considering the difficulty of the task the results have come out with remarkable similarity. In the goat fœtus the coefficient of oxidation appears to be 0·0025 c.cm. ±0·001. On the whole, as the embryonic age progresses there is a tendency for the coefficient to rise, but this is scarcely outside the region of experimental error. Then there is a great rise at birth. The kid a day or two old uses perhaps four times the amount of oxygen which it did when it was in the womb. The same appears to be true of the sheep. The conditions in the sheep fœtus seem so uniform that it is possible by a very simple calculation to arrive at the coefficient of oxidation. If the oxygen in the blood going to the placenta be subtracted from that in the blood emerging along the umbilical vein, and the figure so obtained—namely, the oxygen difference—be multiplied by the blood flow through the placenta, we shall get the coefficient of oxidation. Now we have already obtained a figure for the blood flow, by implication at all events. We have taken the blood flow through the heart as being 0·15 c.cm. per gramme of fœtus per minute, and we have taken the blood flow through the placenta as being the third of this—namely, 0·05 c.cm. per gramme per minute. Therefore the oxygen used per gramme per minute should be 0·05 c.cm., multiplied by the oxygen difference in c.cm. of oxygen per cubic centimetre of blood (Table III.).

TABLE III

Serial number of sheep.	Fœtal age in days.	Cubic centimetres of oxygen in 1 c.cm. of blood.			Oxidation coefficient of fœtus.
		Umbilical.		Difference.	
		Vein.	Artery.		
2	58	0·078	0·028	0·050	0·0025
8	98	0·088	0·048	0·040	0·0020
11	111	0·113	0·069	0·044	0·0022
14	112	0·157	0·104	0·053	0·0027
16	124	0·174	0·052	0·122	0·0061
19	137	0·068	0·017	0·051	0·0026
27	138	0·105	0·059	0·046	0·0023
29	144	0·102	0·038	0·064	0·0032

These results are (with one exception) practically the same as those of the goat, and as they too are very much less than the oxidation coefficient of the lamb we may take it that at birth there is a great increase in the quantity of oxygen consumed. Nor is this the whole story, for the vascular system of the born animal is made not merely to meet its requirements when at rest but to meet them when the organism is in the maximum condition of activity which it can sustain. This is true of the hæmoglobin no less than of any other feature of the vascular system. Therefore the hæmoglobin must in the active organism be able to unload its oxygen when the body is using oxygen not at the rate of 0·01 c.cm. per gramme per minute, but at perhaps ten times that rate.

But to continue the comparison between the organism before and after birth, in respect of the amount of oxygen which it requires, even the so-called resting kid or lamb is not at rest in the sense in which the word "rest" may legitimately be used of the fœtus. The greater part of the oxygen used by the body is used by its muscles; these are always in a state of tone. It used to be argued that muscular tone did not involve any extra use of oxygen and the so-called catch mechanism was invoked in support of this thesis. The new methods of amplification used by Adrian and others have shown that the true nature of tone in skeletal muscle is the contraction of a limited number of muscle-fibres in a given time. Tone must therefore be associated with oxygen use.

My colleague Dr. D. H. Barron has tested, at several periods of fœtal life, the question of whether the skeletal muscles of the fœtus are in a state of tone, and the result has always been the same—namely, that the muscles are perfectly flaccid so long as the fœtus is in its normal environment or in something approximating to it. Nor is there the same reason for the maintenance of tone in the fœtus that

there is after birth. Once the animal is born, it is of the first importance that its body temperature should be maintained. This can only be done by oxidation, and even should tone develop into shivering the effort will be made. The fœtus, however, has no cooling surface of its own, and its presence does not greatly increase that of its mother, but in so far as it does, doubtless the maternal thermotaxic centre is equal to dealing with the situation.

The cogency of what has just been said has been proved by Barron in the following way: in warm saline and with the circulation unrestricted the fœtal muscles are, as I have said, devoid of tone. Take the fœtus out of the saline and expose its skin to the air; tone at once appears in its muscles, only again to be abolished by replacing the embryo in the saline.

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COMBINED DISTANCE RADIATION OF HYPOPHARYNGEAL CANCER

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The treatment of malignant disease of the region of the hypopharynx presents many difficulties. Surgical treatment has been placed on its present high level by the methods originated by Wilfred Trotter which remain the best that surgery can offer. They are limited however in their application to a small minority of cases, where the lesion is confined within the pharyngeal wall and the glandular involvement is limited. Even in such cases surgery is not always acceptable to the patient and the risks are grave in the most skilled hands. Some cases cannot be relieved without sacrifice of the larynx, and this grave mutilation is shown in its true light by Trotter's words: "I should not feel able to record as a true success the cure of a pharyngeal carcinoma won at the expense of laryngectomy." It is therefore natural that radiological methods should be tried out in this group of neoplasms. The outstanding advances in the radiological treatment can be summarised by the work of Coutard in France, Finzi and Levitt in this country, Zuppinger and his assistants in Switzerland, and the workers of the Memorial Hospital, New York, including Quick, Duffy, and Martin. As regards radium, the methods of interstitial and surface therapy have added very little to the practical treatment of these lesions; it is only when we come to mass radiation by large quantities of radium that improvements in results are recorded. In the radium treatment of cancer of the mouth, larynx, and pharynx by distance radium radiation, Berven stands alone as the pioneer of the treatment.

Our contribution to the treatment of cancer of the hypopharynx deals with a method of therapy which can be appropriately described as the "combined distance radiation." This combination of X and gamma radiation is applicable to most neoplasms, but at present we are only concerned with a group of tumours known to the clinician as "extrinsic laryngeal cancer," and including the hypopharynx. For radiological treatment as much as for surgical excision, correct diagnosis, accurate localisation, and careful grading or grouping of the lesions is essential.

FOUR ANATOMICAL GROUPS

The anatomical classification of the cases under consideration comprises the following four groups, which present different clinical features and require different techniques of treatment.

1. *Epipharyngeal Tumours.*—These are the true extrinsic laryngeal growths, originating in the aryepiglottic fold, epiglottis, or arytenoid. They give rise to early loss or modification of the voice and should be recognised with ease.

2. *Tumours of the Posterior or Lateral Pharyngeal Wall.*—In this group of cases the growth originates well away from the arytenoids, its possible level extends from the region of the uvula above to the post-cricroid area below; it may be confined to the posterior wall only or encroach on one or both lateral walls, or it may originate on the lateral wall. It extends inwards and may overhang the arytenoids and vocal cords, which, however, remain freely mobile.

3. *Pyriform Fossa Tumours.*—These constitute by far the commonest group. Early diagnosis is quite exceptional; glandular involvement is the rule and may at times be the first abnormality noticed by the patient. The mortality of this group is so high and operability so low that any other method capable of dealing with the disease must be seriously considered.

4. *Post-cricoid Carcinoma*, characterised by early dysphagia, the preponderance amongst women and the few signs visible on indirect examination in early cases. For such cases valuable diagnostic help can be obtained from careful skiagrams of the neck. The characteristic appearance is the displacement forward of the larynx and trachea and the ovoid shadow of the tumour prevertebral in position (Fig. 1).

In the clinical diagnosis of these cases we have had the advantage of the coöperation of a large number of laryngologists and we take this opportunity of expressing our thanks to them. The cases referred for treatment were seen and diagnosed by one or other of the following laryngologists: Mr. Gilbert Chubb, Mr. Douglas Harmer, Mr. F. C. Ormerod, Mr. W. Ibbotson, Mr. G. A. Simpson, Mr. N. A. Jory, Mr. Gill-Carey, Mr. N. Asherson, and Mr. E. Carew-Shaw. Our cases therefore were drawn from various hospitals, including Westminster, St. Bartholomew's, Mount Vernon, Ear, Nose and Throat Hospital, Golden-square, Central London Ear, Nose and Throat Hospital, and the Bolingbroke Hospital. Clinical diagnosis was always confirmed by more than one observer; in the majority of cases a biopsy and histological confirmation of malignancy preceded treatment.

HISTOLOGY

The histological classification of the tumours of the upper air and food passages varies from country to country; grading is somewhat arbitrary, and the following three groups cover the various types met:

(1) Squamous-celled carcinoma (with cell-nests).
(2) Transitional-celled carcinoma (without cell-nests).
(3) Lympho-epithelioma.

These three entirely different histological varieties of epithelial cancer may represent three phases of biological activity, the practical importance lies in the different life-histories of the three groups and their different degrees of radiosensitivity. Correlation

between histological grouping and radiosensitivity showed that whereas lympho-epithelioma is always highly radiosensitive, the epidermoid type varies in its response and some squamous-celled tumours with cell-nests prove as sensitive as the more undifferentiated types. The gross physical characteristics of the lesion are as good if not a better guide to sensitivity than the microscopical grading. The cauliflower exuberant lesion responds better than the ulcerative infiltrating or nodular type, in accordance with the general rule. Sepsis, necrosis of tumours, or œdema militate against successful radiotherapy. Post-operative or post-radiation failures were not excluded from the series of cases treated by the combined method.

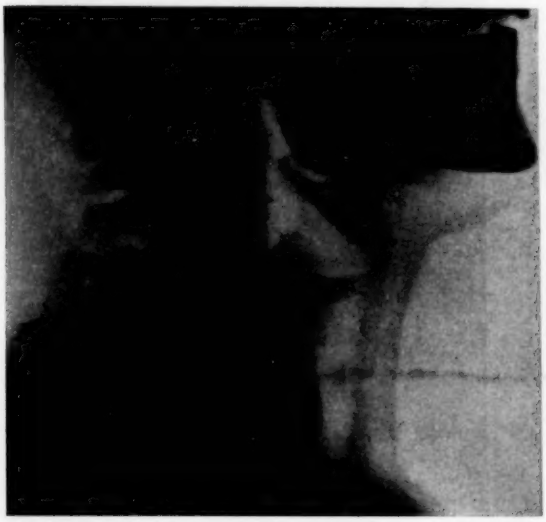

FIG. 1.—Skiagram of neck showing post-cricoid tumour and forward displacement of trachea. Note the distance between trachea and vertebral column; this is typical of the lesion.

TREATMENT

All patients were examined by indirect laryngoscopy; the situation, extent, and type of lesion were determined; oral hygiene and dental treatment precedes active irradiation. Skiagrams of the chest, neck, and a barium swallow are carried out; full blood counts are done weekly. The skin of the neck and the mucous membrane of the mouth are inspected daily, a complete laryngological examination is done weekly or twice weekly; in some cases daily. About one-third of the total number of patients treated are not hospitalised.

The method of treatment consists in a combination of radiation in the following order:

(1) Preliminary X radiation for 5 days.
(2) Simultaneous X and gamma radiation.
(3) Gamma radiation with the 2-gramme radium unit continued after cessation of X rays.

The use of radium and X rays in combination is not a new development. It has been used in many regions of the body, chiefly, however, by the method of needling with X rays as a preliminary or subsequent procedure. In America X rays have been used for several years in combination with the radium pack. Levitt, in 1930, stated that in the cases in which planned combined treatment was carried out, the results appear to be distinctly better than those treated by X rays alone. In many of these cases, he said, adequate treatment by radium alone would have been impossible in the first instance. In the treatment of the tongue, tonsil, and vallecula, he says also, that, where practicable, radium should always be combined with X rays. As far as we are aware, X rays had not been used in this country in combination with beam radium therapy previous to 1930, when the earliest cases were treated at Westminster Hospital. Since that date we have employed the combined method in many regions of the body, and in very varied types of malignant disease.

The remarks made by Quick at the International Conference on Cancer held in London in 1928 suggested a possible new method of attack on the malignant process. In speaking of the use of the 4-gramme radium pack and X rays, Quick says:

> "Our clinical observations were to the effect, that the practical results produced were superior to those where radiation of one wave-length only was used. We noted, furthermore, that bearing in mind the quantitative factor a relatively greater quantity of the combined radiation *within the limits of skin tolerance* could be given within a fixed interval than was possible where radiation of only one type was used."

Having at our disposal a constant potential X ray apparatus capable of giving 200 kilo-volts and a 1-gramme radium unit (afterwards increased to 2 grammes), we felt that this was an opportunity to test the method on carcinoma of the upper air passages. The rationale underlying the combined method is based on the following observations:

1. It was pointed out by Douglas Quick that a larger tissue dose can be given with safety and comfort by the combined method than by either method alone. If the total maximum dose given by each method alone is represented by 100 per cent., allowing a reduction of 25 per cent. for each type, a total dose of 150 per cent. can be delivered by the combined method.
2. It appears from observation of the cases treated that a variation of the wave length used increases the degree of radiosensitivity.
3. The local tolerance of the skin and mucous membrane is increased.
4. The limit of general tolerance of the patient is never reached before the limit of the local tolerance of the skin or mucous membrane, so that treatment need not be interrupted before an adequate dose is delivered.

TECHNIQUE: RADIUM

The bomb used is the fifth model constructed for Westminster Hospital (Fig. 2). It is of small dimensions, ovoid in shape, consisting of a spherical upper portion made of lead and a lower part cone-shaped made of gold. Its weight is 38 lb.; the external diameter is 14 cm., the internal diameter of the radiation channel is 3·5 cm.; the gold mouth is 1 cm. thick and 3 cm. long. The bomb is suspended over a pulley and counterpoised with a block of lead. It is easy to handle and stays in the position in which it is placed. A cone-shaped metal holder, the exact replica of the bomb, is accurately placed in position over the port of entry to be treated and fastened by rubber bands (Fig. 3). This is done outside the bomb room; the patient then comes into the treatment room, is placed on a couch which is swung into position under the bomb, and the attendant lowers the bomb into the cup; the bomb is attached to the cup in a few seconds. The radium contained in the bomb at present is 2 grammes in 9 tubes. The radium skin distance can be varied at will up to 7 cm.

Multiple small ports of entry are used. The number of ports varies with the situation and extent of the lesion and the presence of glandular metastases. Pyriform fossa lesions and lateral pharyngeal lesions are treated through 4 or 5 ports on one side of the neck; aryepiglottidean lesions through 3 ports on one side (Fig. 4) and postcricoid tumours through 2 ports one on each side of the neck; recently a third anterior central port has been added. The radium skin distance was originally 3 cm. but was gradually increased so that to-day 6 or 7 cm. radium skin distance is used in most cases. Each patient is treated 5 days a week and receives 2 treatments of 50 minutes each in the 24 hours. Occasional periods of rest, variation in the frequency of the treatments, and changes in the ports are dictated by the reaction of the skin and mucosa and by the response to treatment. The total period of treatment, including rests, extends over 6 to 7 weeks.

TECHNIQUE: X RAYS

A constant potential stabilovolt generator is used actuating a Siemen's multix 190 K.V. tube. Our kilovoltage has been 180 throughout. Filtration used 1·5 mm. copper + 1 mm. aluminium, except in the very early cases, when only 0·5 mm. copper was used. Lately a Thoraeus filter, whicl. is equivalent to the 1·5 mm. copper, but which gives a more homogeneous beam, has been used. Focus: skin distance used is 45 cm. and at times 50 cm., and the size of the fields varies from 80 to 150 square centimetres.

As the metastatic spread is via the lymphatics, it seems to us that as widespread irradiation as possible consistent with safety should be used. Unlike Dr. Coutard and Dr. Hayes Martin, any ill-effects from the use of the larger fields have not been noticed, but this is most likely because the daily doses are smaller. Daily doses of from 120–180 r. units are given for five days a week, thus allowing two complete days rest in every seven.

Several minor variations to the main plan of treatment have been tried but the routine now is for the X radiation to precede the bomb on the affected side, or if the growth should be centrally situated or extend to both sides, for the X rays to be given to both sides before starting the gamma radiation. The bomb is then started and the X rays carried on with on the opposite side to the lesion and often from a posterior field in addition. This in many cases means that the X radiation is finished before the gamma.

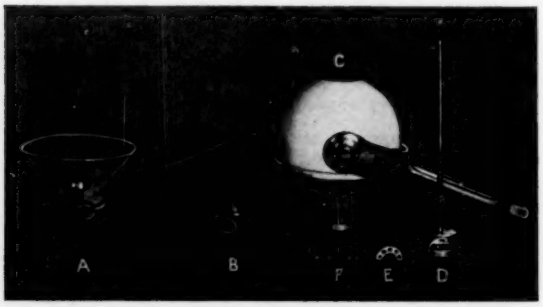

FIG. 2.—Components of the Westminster bomb. A and B metal cups, applied to patient outside bomb room. C bomb: upper part in lead, lower containing gold screen. D radium carrier, inside the bomb. E horse-shoe shaped container for five units of radium; this is inserted into D. F radium units, placed into E.

EFFECTS OF TREATMENT

(1) *Reaction of the skin.*—With increased radium skin distance, the cutaneous reaction has diminished in degree to a very appreciable extent. It is now possible to avoid moist peeling of the skin (Regaud's selective radio-epitheliitis). The appearance of erythema varies in individual patients; at 6 cm. distance, 10 hours' treatment can be given to each port before the erythema occurs. Dry peeling, pigmentation, and crusting are obtained towards the end of the treatment. It must, however, be emphasised that it is the mucosal reaction and not the skin reaction which is the determining factor of dosage, and treatment must be continued if other conditions dictate it, till full peeling of the skin is obtained. If blistering and peeling take place, healing follows in 10 to 14 days.

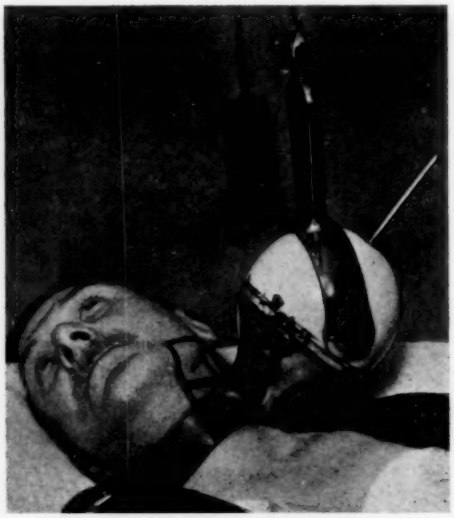

FIG. 3.—The bomb in position.

(2) *Reaction of the mucosa.*—Œdema of the mucous membrane, specially œdema of the arytenoids, is an early reaction; it occurs on the 3rd or 4th day, is transient, and gives rise to slight discomfort; towards the end of the treatment, œdema recurs and must be carefully watched; as a result of the treatment there is redness and dryness of the mucous membrane; occasionally a mild fungus infection of the palate and fauces occurs—this is an indication for interruption of treatment which can be resumed within a few days. In two cases only, both very advanced, was tracheotomy required in the middle of the treatment; in one case tracheotomy became necessary five weeks after cessation of treatment.

(3) *Perichondritis.*—No damage to the cartilages of the larynx or trachea has been observed so far up to periods of 3½ to 4 years after treatment. As this sequela is possible however as long as 7 or 8 years after cessation of treatment it cannot be excluded to date.

(4) *Blood changes.*—There is a progressive fall of leucocytes with a greater relative fall of lymphocytes throughout the treatment in the great majority of patients but not in all. The maximum fall is to 2000 total leucocytes and 250 lymphocytes. These changes are transitory, rapid recovery taking place during the periods of rest and on cessation of treatment.

General symptoms of radiation sickness are entirely absent.

CLINICAL COURSE

General constitutional disturbances have been very few and slight. A certain amount of depression, which is a very common feature, and loss of appetite, are the worst. We must remember as always that it is the patient we are treating and not alone the disease. This often necessitates modification of treatment, which would not otherwise be carried out. All factors relating to the general condition and habits of the patient must be considered. Whenever possible, cases are best treated as in-patients, thus avoiding daily journeys and fatigue, with risk of exposure to cold and infection. But neither the local reactions nor the effect on the general health are such as to preclude out-patient treatment throughout if the patient desires it. Smoking should be reduced to a minimum, or given up entirely where possible, but if this would militate against the patient's outlook, we prefer to let him continue. One inveterate smoker (as well as alcoholic) was treated with good palliative results, and lived in comfort for 16 months without renouncing either of his habits.

FIG. 4.—Ports of entry mapped out with Finzi's ink.

Frequent examination of the skin and mucous membranes is important, their exact condition being noted from week to week, if not from day to day, together with the state of the tumour. If not competent to make the examinations himself, the radiologist should seek the aid of a laryngologist or other clinician.

DOSAGE

The notation of dosage in distance mass therapy can be done by various methods. The total dosage could be indicated by milligramme or gramme hours; this, however, is most unsatisfactory unless all possible data are given—namely, quantity of radium, screenage, radium skin distance; frequency of treatments; duration of each treatment; total period of treatment; and number and position of ports of entry. Even then the dosage so indicated is the dosage given by the apparatus to any particular skin area. As the lesion-skin distance varies with the various ports and as the radium skin distance is also varied in some cases, the futility of such notation of dosages can be seen from Table I.

TABLE I.—*Dosage Data—2-gramme Bomb*

Based on measurements in water and assumption 1 imc. = 8·0 r/hr.

Ra-skin distance, cm.	Skin intensity in r/min.	Skin dose per hour in "r."	Percentage depth dose 10·0 cm. below skin.	Skin dose every hour in milligrammes.
3·0	18·3	1100	5·8	2000
4·0	11·8	708	8·15	2000
5·0	8·3	498	10·1	2000
6·0	6·44	386	11·1	2000
7·0	4·75	285	13·2	2000

prepared by Mr. C. W. Wilson, assistant physicist to the Westminster Radium Annexe.

The only true method is to calculate or measure the dosage received by the tumour. For this purpose isodose curves have been prepared by the physicist of the department.* The intensity received by the tumour through various ports of entry can be obtained from the following curves prepared by Mr. Wilson (Fig. 5).

The total X ray dose on the tumour varies from one to two and a half erythema doses. This is made up by the fields already mentioned, and is approximately of the order of 1000 r. from the affected side, and 1300–1600 r. on the skin from the opposite side and the posterior field. No hard-and-fast rule as to the number of r. units to be given can be followed; every case must be judged as it proceeds and doses increased or treatment suspended according to the state of the tumour and the reactions. Numerous failures and increasing experience serve to strengthen our conviction that nothing short of the fullest possible dose on the tumour must be aimed at. This means that the skin will be damaged to a certain extent but this must be disregarded; if the treatment is given slowly enough, the skin will heal well and return to its original state. With larger quantities of radium and the possibility of still greater radium skin distances and harder X rays, it may be possible to deliver the necessary tumour doses without skin damage. In those cases where metastatic glands are present, the doses must necessarily be larger than where no palpable glands are noticed, as a larger volume of tissue has to be irradiated.

The total doses received by the tumour in the various successful cases is shown in Table II.

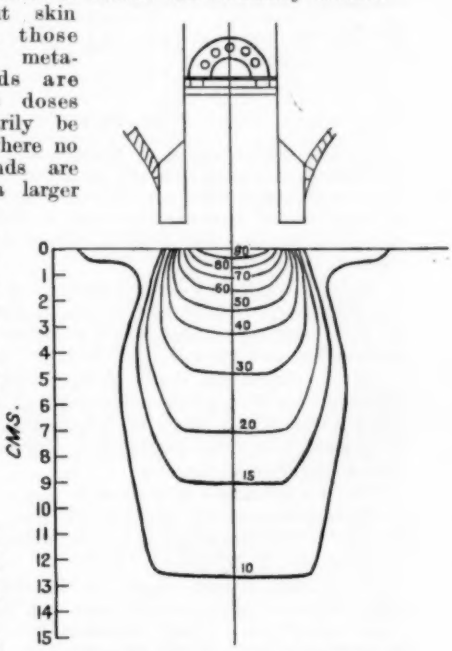

FIG. 5.—Isodose curves of the 2-gramme unit Westminster bomb. Radium-skin distance, 6 cm. Skin intensity, 8·0 r/min.

RESULTS

The number of cases treated by the combined method during the past three and a half years is shown in Table III.

The longest period of survival to date is three and a half years. One case died from other causes, free from disease by histological examination after complete post-mortem examination. Among the non-successful cases are two groups: (1) those, the majority, in which initial improvement and even total disappearance of the disease was followed by local recurrence within periods varying from 6 to 18 months; (2) those in which the disease

* See THE LANCET, 1933, ii., 4.

progressed in spite of, and actually during the treatment.

TABLE II

Case No.	Disease.	Tumour dose. Gamma rays.	Tumour dose. X rays.	Time since end of treatment.
		Total: r units.		
1	Pyriform fossa.	3,190	890	3 yrs.
2	,, ,,	4,400	790	1 yr. 3 mths.
3	,, ,,	5,800	997	1 yr.
4	,, ,,	4,950	930	9 mths.
5	,, ,,	2,940	1,600	7 mths.
6	,, ,,	—	—	—
7	Post-cricoid.	3,600	1,200	9 mths.
8	,,	6,200	660	—
9	Post-pharyngeal.	7,080	190	1 yr.
10	Epipharyngeal.	4,650	850	8 mths.
11	Tonsil.	7,140	530	5 mths.
12	Lat. pharynx.	6,720	530	5 mths.
13	Larynx gl.	11,500	540	—

TABLE III

—	Cases.	Alive and free from disease.
Pyriform fossa	23	7
Post-cricoid	10	3
Lateral and posterior pharyngeal	7	3
Epipharyngeal	12	4
Total	52	17

CONCLUSIONS

(1) The combination of X rays and radium is a deliberate attempt to treat extrinsic laryngeal cancer by an irradiation of different wave-lengths, as this appears to increase the radiosensitivity of the tumour and to lead to retrogression of the disease.

(2) The treatment is safe and, as compared with the intensive methods of Coutard in Paris or Martin in New York, produces less cutaneous and mucosal destruction and is well tolerated.

(3) No claims are made either as to permanency of results or to a great percentage of clinical cures. Of a total of 52 cases of hypopharyngeal cancer, 17 remain free from disease for periods up to three and a half years.

(4) Two grammes of radium is not considered the best possible quantity, and the intention is to increase the bomb to four grammes in the future, and further as opportunity arises.

(5) Finally a few words as to the future—the possibilities of this method have not by any means been exhausted. Many mistakes have been made, and from these much has been learned. The question is, Will the method be an improvement on previous methods? The brilliant results achieved with X rays alone by Finzi and Coutard are well known. On the other hand, equally wonderful results are shown to us by Berven with gamma rays alone. Is there, then, any special virtue in the two agents when used together which is not possessed by each when used alone? We know that there is a biological difference in the effect produced by (say) infra-red and ultra-violet radiation. Why should there not also be such a difference, when using widely differing wave-lengths of X and gamma radiation? Many tumours, when treated with one type of radiation only, will proceed to a state of partial regression and then remain stationary or start again in active growth. It is our contention that, with the combined method, the number of such partial successes is very materially reduced, and that when the process of regression begins to slow down under one wave-length, the addition of the other supplies the necessary stimulus to complete healing.

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TREATMENT OF LOW-CALCIUM TETANY WITH CALCIFEROL

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LOW-CALCIUM tetany is met with in dietetic deficiency states, in disorders of the intestinal tract such as steatorrhœa, following thyroidectomy, and as an idiopathic condition probably due to hypo-parathyroidism. It is with the treatment of the two latter that this paper is concerned.

Idiopathic tetany is rare, but owing to the frequency with which a subtotal thyroidectomy is now done, post-operative tetany is not uncommon. Many cases respond to calcium or acid medication, but others are met which cannot, by these means alone, be kept free from symptoms and some additional line of treatment must be sought.

As a treatment for an acute attack, parathormone, given intermuscularly is more convenient though less rapid in its action than the only alternative—namely, the intravenous injection of calcium salts—but its regular use over long periods has several disadvantages. It is expensive and, because of its relatively rapid action, difficult to control. Further, with prolonged use, there is some risk of decalcification and it has frequently been found to have a steadily decreasing effect.[1 2]

As an alternative to parathormone various irradiation products of ergosterol have been given by mouth (for references see Reed and Seed,[3] Snapper,[4] Schultzer,[5] and Boothby).[6] Vitamin D, in the small doses used for the treatment of rickets, is usually ineffective in cases which do not respond to simpler methods of treatment. The following is a description of the course of three patients who have been treated for a considerable period on large doses of pure vitamin D (calciferol). In each case gelatin capsules containing 2 or 4 mg. calciferol (80,000–160,000 international units vitamin D) dissolved in olive oil have been used. A similar case was reported by Elliott[7] while the present paper was in preparation.

CASE RECORDS

CASE 1. *Post-operative tetany.*—On Jan. 5th, 1934, the patient, a woman of 24, underwent subtotal

thyroidectomy for hyperthyroidism. The operation was quite straightforward and two small pieces of gland were left on either side of the trachea. The parathyroid glands were not seen. On the fourth day after operation a severe attack of tetany developed with laryngismus, carpopedal spasm, and a positive Chvostek sign; the serum calcium was 7·0 mg. per 100 c.cm. The attacks were controlled by parathormone, but recurred on discontinuing the injections. For the first nine days after operation there was an irregular pyrexia without any symptoms or signs to account for it. Fig. 1 shows the blood changes after the first six weeks after operation. The preliminary fall in the blood calcium is due to the discontinuance of parathormone treatment. From the first onset of symptoms the patient has had calcium gluconate grs. 180 t.d.s., and from the eighteenth week Thyroideum Siccum B.P. gr. ¼, t.d.s.

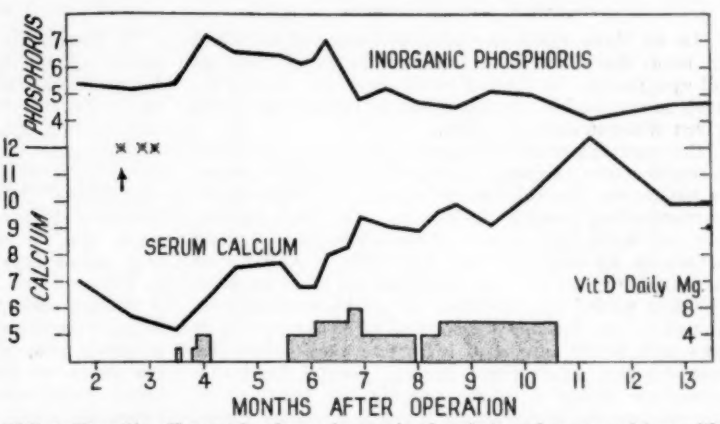

FIG. 1 (Case 1).—Changes in plasma inorganic phosphate and serum calcium with various doses of vitamin D. * = active tetany. † = injection of parathormone.

CASE 2. *Post-operative tetany.*—The patient was 51 years of age and had a subtotal thyroidectomy done for toxic adenoma on Sept. 20th, 1934. Five days later active tetany developed and was controlled by parathormone injections and calcium gluconate grs. 180 t.d.s., for the following three weeks. Calcium gluconate has been administered ever since. On discontinuing the parathormone tetanic attacks occurred daily for a week when treatment with calciferol was started. The Table indicates the subsequent course throughout which tab. thyroid (sicc.) gr. ½ b.d., was given for a mild degree of myxœdema. After starting calciferol no cramps were experienced until Jan. 1st, 1935, when the serum calcium had fallen to 7·7 mg. per 100 c.cm. During the latter period, when the calcium ranged between 7 and 8 mg. it is interesting to note cramps were only experienced on the days immediately following the menstrual periods.

—	Serum calcium. mg. Ca. per 100 c.cm.	Plasma inorganic P. mg. P. per 100 c.cm.	Calciferol.
1934.			
Oct. 12th ..	6·7	5·7	None.
,, 25th ..	6·8	5·3	4 mg.
Nov. 2nd ..	8·1	6·0	4 mg.
,, 8th ..	8·1	5·2	4 mg. b.d.
,, 15th ..	10·7	5·4	4 mg.
,, 20th ..	—	—	Discontinued.
Dec. 21st ..	7·7	3·5	None.
1935.			
Jan. 30th ..	7·1	4·8	4 mg. b.d. for one week.
Mar. 14th ..	8·3	3·8	None.

b.d. = twice daily.

CASE 3. *Idiopathic tetany.*—Male, aged 33, a boot repairer. After an attack of influenza in January, 1933, the patient was seized with severe cramp in the hands. These continued intermittently, being brought on particularly, but not always, by work, till an exceptionally severe attack involving the muscles of the face and throat, making breathing difficult, brought him to hospital in March, 1933, in a typical tetanic attack. Blood calcium was then 6·2 mg. per 100 c.cm. He was treated with calcium chloride intravenously and parathormone and discharged free from symptoms with a blood calcium of 8·1 mg. As an out-patient he was treated on 2 pints of milk daily, calcium gluconate grs. 120 t.d.s., and Ostelin ♏ 3 t.d.s. (3000 units). Throughout the year he had invariably positive Trousseau and Chvostek signs with attacks of active tetany sometimes daily. At no time were there any other abnormal physical signs, nor any changes in skin, hair, nails, or lenses.

On Dec. 7th, 1933, when Fig. 2 starts, the calcium was 5·1, inorganic phosphate 8·0 mg. per 100 c.cm. A period of artificial sunlight resulted in a sudden rise in the calcium, a drop in the phosphate, and the disappearance of symptoms. A further period of artificial sunlight produced a similar effect on the phosphate but no corresponding rise in calcium. Shortly after starting calciferol both the Chvostek and Trousseau signs became negative. Fig. 2 shows the subsequent blood changes.

There has been one attack of active tetany only. This was not actually witnessed and all information concerning it rests on the patient's description. Three days later the serum calcium was 13·0 and the phosphate 3·5 mg. per 100 c.cm. Such attacks with a high calcium have been described by Reed and Seed.[3] The prolonged contraction of the small muscles of the hands which is required by the patient's work is a very sensitive test for latent tetany, and if the serum calcium is about 9 mg., cramps tend to develop after three or four hours' work when other signs of latent tetany are lacking. In his case, therefore, it is necessary to adjust the blood calcium with a greater nicety than would otherwise be needed.

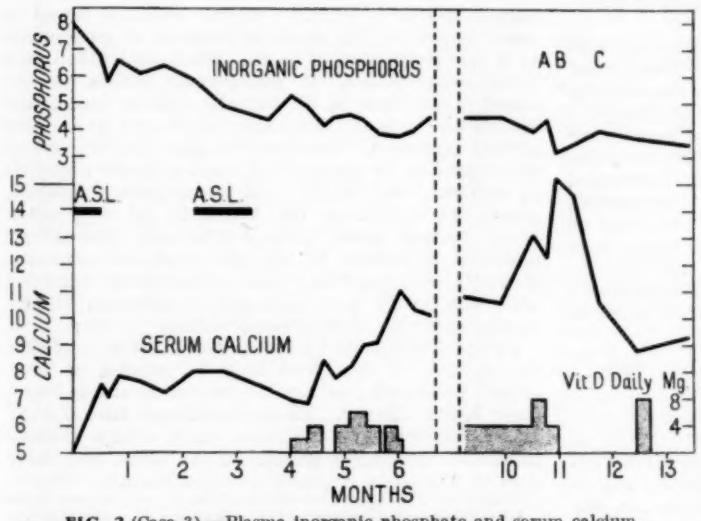

FIG. 2 (Case 3).—Plasma inorganic phosphate and serum calcium. A.S.L. = artificial sunlight. A B C refer to dates mentioned in text.

ACTION OF CALCIFEROL

In all three cases the administration of calciferol in large doses has been followed by rapid relief of all symptoms. In Case 3 small doses of vitamin D, such as are used in the treatment of rickets, had been given without definite effect.

Concomitant with the relief of symptoms there was a rise in serum calcium. A distinct cumulative action is noticeable, the calcium continuing to rise without corresponding increase in dosage. On discontinuing the calciferol, the serum calcium does not at once return to its original level, but there is a delay of a month or more. For example, in Case 1, after the first period on calciferol, the serum calcium continued to rise for five weeks, and after the second it was well above the basal level ten weeks after the last capsule. Variations in the plasma inorganic phosphate follow a course roughly the converse of the calcium changes, tending towards a normal value. It will be noticed however that on starting on calciferol a sharp rise in the phosphate often occurs, followed later by a fall.

TOXIC SYMPTOMS

Reference to the literature for the toxic symptoms to be expected with calciferol is of little assistance because in most cases pure substances have not been used, and it is well known that the various irradiation products of ergosterol differ greatly in toxicity. Reed [8] states that large doses of viosterol produce: anorexia, nausea, vomiting, and diarrhœa; frequency of micturition without polyuria; loss of weight; muscular weakness, lassitude, dull aching in the muscles, muscular incoördination and disturbed equilibrium. In animals calcification of the heart, arteries, and kidneys has been produced and urinary calculi been found. Extreme overdosage results in decalcification of the bones.

In Case 1, after the patient had taken a total of 728 mg. calciferol during five months, she suddenly developed anorexia and occasional slight epigastric pains after meals. In six months her weight had fallen from 8 st. 4 lb. to 7 st. 11 lb. The hæmoglobin was 52 per cent. On discontinuing the treatment these symptoms at once disappeared; she started to gain weight and the hæmoglobin rose rapidly to 85 per cent. on iron. In Case 3 there was also a slight loss of appetite, but the patient's weight fell by only 3 lb. during four months in which he took 556 mg.

The urine has been examined regularly in all cases and there has been no albuminuria. The blood pressure also has remained normal and no abnormality of bone or kidney has been found radiologically.

In Case 3, with considerable calciferol overdosage and a serum calcium of 15 mg. per 100 c.cm., the serum developed a yellowish-brown coloration. The pigment was soluble in ether (unlike bile-pigments) and chloroform. No pigmentation of the skin or conjunctivæ could be detected. It was found that the depth of colour could be estimated satisfactorily by the icteric index, and the following Table indicates its subsequent disappearance. The letters refer to points in Fig. 2.

Date.		Icteric Index.
Oct. 4th, 1934	A	23
,, 11th ,,	B	15
Nov. 1st ,,	C	10

In these cases then, provided there is no hypercalcæmia, some loss of weight and appetite, and in one case a considerable degree of anæmia, are the only toxic effects which have been observed.

METHOD OF TREATMENT

In treating a case with calciferol it is obviously necessary to supply adequate calcium in the diet for absorption and to minimise the risk of decalcification. To this end calcium gluconate and extra milk have been given.

The calciferol itself can be given either continuously or at intervals. The former requires, owing to the cumulative effect, frequent blood estimations. Recently the second method has been used with these cases and it has been found that a short period (e.g., seven days) on a fairly heavy dosage (4 mg. b.d.) is followed by a long period free from symptoms. A further short course is given when signs of latent tetany develop. The total amount of calciferol used is much less, if it is given in this way, and there has been no loss of weight or appetite. Periodic blood estimations are required to ensure against hypercalcæmia.

SUMMARY

(1) The progress of three cases of low calcium tetany, treated with calciferol, is described. (2) It has been found possible to maintain the patients free from symptoms with normal blood findings. (3) Possible toxic effects are discussed.

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AZOTÆMIA IN ACUTE BRIGHT'S DISEASE

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IT is not yet known how frequently the non-protein nitrogen (N.P.N.) of the blood is raised in acute nephritis, but there is evidence of an increase in a fair proportion of cases. MacLean [1] found that some accumulation of nitrogenous bodies in the blood takes place in all but the mildest cases, and Moorhead [2] stated that the blood-urea is almost always increased. Crawford [3] reports an increase of blood-urea in 70 per cent. of cases of acute nephritis in children, and Boyd,[4] also investigating children, found the N.P.N. of the blood to be very often above normal limits, while Lyttle and Rosenberg [5] observed azotæmia in 63 per cent. of 49 cases. Recently Murphy [6] and his collaborators recorded azotæmia in 71 per cent. of 94 patients, chiefly adults, suffering from acute nephritis.

Peters and Van Slyke [7] state that in acute nephritis the N.P.N. of the blood may be normal or very greatly increased; as a rule a moderate rise is found early in the disease. They have found that N.P.N. may be increased in the blood while a high concentration of nitrogen is present in the urine, and there may be actually a negative nitrogen balance. Hence

* The work was done during the tenure of a Carnegie research scholarship.

they believe that azotæmia is not to be ascribed entirely to diminished renal function but is partly due to increased nitrogen metabolism resulting from the acute infection often present in acute nephritis.

The present paper records the N.P.N. of the blood of 98 children, estimated at various stages of the disease. All the patients were under thirteen years of age, and one could be reasonably sure that they were all suffering from acute Bright's disease uncomplicated by chronic cardiac or renal lesions. The method used was that of Folin and Wu.

THE FINDINGS

Incidence.—The number of children admitted to hospital in the first week of the disease was 63, of whom 38 (60 per cent.) showed a N.P.N. over 40 mg. per 100 c.cm. (the upper limit of the normal), 7 having a concentration of over 100 mg. Of the 35 patients admitted in the second week of illness, 18 (51 per cent.) showed azotæmia, 3 having a blood N.P.N. of above 100 mg.

Relation to the Blood Pressure.—No relationship could be found between the level of N.P.N. and of the blood pressure; high readings were obtained with the sphygmomanometer when there was no azotæmia, and, on the other hand, a considerable rise of N.P.N. was not uncommon when there was no rise in blood pressure.

Relation to Œdema.—The amount of œdema gave no indication of the degree of azotæmia. Some cases with massive œdema showed no rise in N.P.N., while others, equally œdematous, had definite azotæmia. From Table I. it will be seen that the average value for blood N.P.N. in cases without œdema was no greater than in those with obvious dropsy.

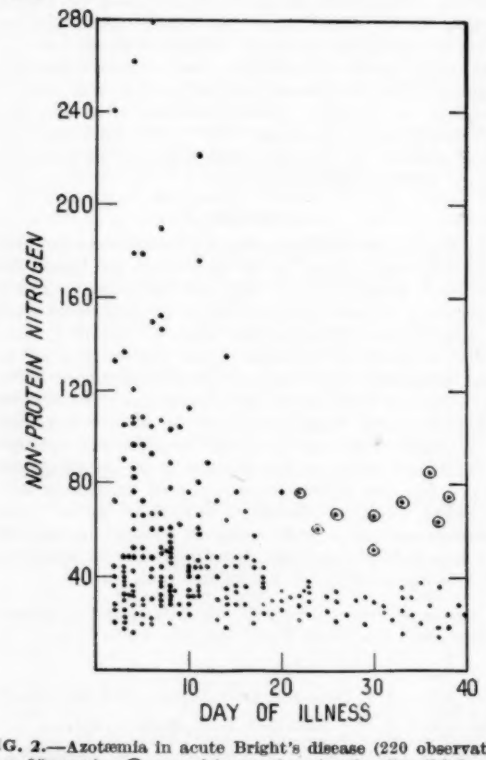

FIG. 2.—Azotæmia in acute Bright's disease (220 observations on 98 cases). ⊙ =persistence of azotæmia after third week, indicating grave prognosis.

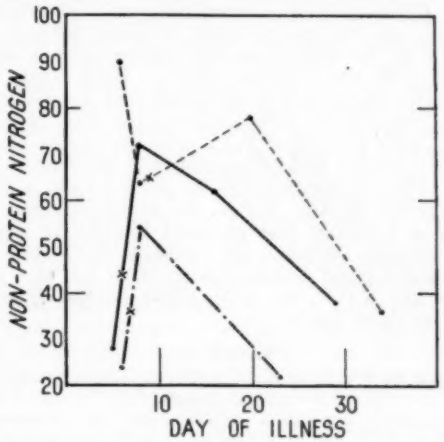

FIG. 1.—Rise in non-protein nitrogen (mg. per 100 c.cm.) after cessation of cerebral manifestation in acute nephritis. × =convulsions ceased following withdrawal of blood and cerebro-spinal fluid.

Cerebral Manifestations.—It is known that the N.P.N. is by no means constantly above normal in acute nephritis with nervous manifestations; nor is there any relation between the incidence or severity of the convulsions and the degree of azotæmia

TABLE I

Œdema and Non-Protein Nitrogen

Œdema.	Cases.	N.P.N. mg. per 100 c.cm.	
		Average.	Range.
0	12	60·0	20·6–190·0
− +	29	49·6	19·1–113·0
+	27	55·4	22·4–176·5
+ +	30	63·5	17·0–280·0

(MacLean,[1] Boyd,[4] Aldrich,[8] Nobécourt,[9] Holt[10]). Indeed Evans[11] has lately reported 7 cases in only 1 of which the N.P.N. was raised and that but slightly. Of the cases under my observation 12 showed cerebral manifestations, and 8 of these had azotæmia, the highest N.P.N. being 280 mg. per 100 c.cm. Two of these patients died. The level of the N.P.N. proved to be of no prognostic value: the patient with the highest level did not die although after eighteen months there is still evidence of kidney damage.

One patient, semi-conscious on admission, with a N.P.N. of 280 mg., did not develop convulsions until four days later when that level had fallen to 133 mg. In 3 cases the N.P.N. actually showed an appreciable increase after the cessation of all nervous manifestations (Fig. 1).

VALUE OF N.P.N. ESTIMATION IN PROGNOSIS

Fig. 2 shows the results of 220 observations on 98 cases of acute nephritis. In all but 4 cases the azotæmia, when present, had disappeared by the fourth week of the disease. The observations made on these cases after the third week of the disease are indicated in Fig. 2 by ringed dots. Two of these patients died and gross renal damage persisted in the other two. The 5 other deaths in the series occurred from some complication such as pneumonia or meningitis.

In the large majority of cases a fall in N.P.N. coincided with loss of œdema, fall in blood pressure,

and diminution of hæmaturia and albuminuria. There was no recognisable relation between the height of the N.P.N. at the commencement of the illness and the ultimate result. High levels were generally associated with satisfactory convalescence later, whereas 4 cases approaching the nephrotic type, with normal N.P.N., ran the usual chronic course. These results confirm the general opinion that little information can be gained from a single observation of the N.P.N. in acute nephritis. It appears, however, that repeated analysis is a guide to prognosis, since in the present series death or permanent renal damage occurred in all the cases where the N.P.N. remained above normal after the third week of illness.

TABLE II

Fall in N.P.N. of Blood with Comparatively High Protein Intake

Case.	Age in years.	Day of illness.	Diet.	Protein g. per day.	Protein per kg. body-weight (œdema free).	N.P.N. mg. per cent.
1	8	4	Milk.	44·0	2·6	96·7
		8				51·7
		12				49·1
		16				30·5
		24				25·0
2	10	6	Milk.	44·0	2·1	280·0
		11				222·0
		14				133·0
		20				32·7
		26				30·4
		32				23·0
3	6	3	Milk.	36·0	2·0	74·6
		11	Full diet.	63·0	3·5	30·9
		31				28·3
4	9	5	½ milk.	22·0	1·0	109·1
		7				105·2
		9				60·6
		11				49·1
		18				28·0
		25				38·7
5	5	5	½ milk.	22·0	1·7	179·4
		7				150·0
		9				103·4
		11				76·9
		18				36·6
		25				35·3
6	12	5	Milk.	51·0	2·1	48·7
		8				32·2
		13				32·4
		22				34·4
7	6	2	½ milk.	22·0	1·5	240·0
		4				263·6
		7				136·3
		12				44·7
		19				25·0
		29	Full diet.	63·0	3·5	32·0
		34				22·0
8	3	5	Milk.	44·0	3·4	35·7
		7				31·0
		10				30·4
		13				31·4
9	2	4	Milk.	37·0	3·7	26·2
		9				30·1
		20				31·5

RELATION OF DIET TO AZOTÆMIA

It has long been customary, because of the acute inflammation of the kidney and consequent diminution of renal excretory power, to impose on the patient with acute nephritis a very restricted diet, at least in the early stages of the disease. Protein in particular is held to be harmful, apparently because of the azotæmia. Ellis,[12] Fishberg,[13] and others have emphasised this point and recommend virtual fasting in the first days of the illness, only fruit juice and a quantity of water being permitted. More recently Bennett[14] has suggested that the fall in blood-urea in acute nephritis is attributable to this meagreness of diet, citing a case where a blood-urea of over 200 mg. per 100 c.cm. returned to normal in about ten days. While this is an attractive hypothesis, it should be mentioned that there are few figures available relating to behaviour of the N.P.N. in patients taking more food.

In the cases here recorded the routine diet on admission to hospital was milk or milk and water, varying in quantity with the age of the patient. The amount of protein ingested ranged from 17 to 51 g. daily. In Table II. are shown 7 cases (Nos. 1–7) in which azotæmia was present on admission and in which the N.P.N. returned to normal within three weeks. Even from this small number it seems justifiable to conclude that fasting is not essential for a rapid fall in the N.P.N. level, and that a considerable amount of protein in the diet does not interfere with the fall. Table II. also includes 2 cases (Nos. 8 and 9) in which the N.P.N. of the blood did not rise, although the patients were having each day over 3 g. of protein per kg. of body-weight.

These observations show that a diet of milk, containing a considerable amount of protein, has no apparent adverse influence on the azotæmia of acute nephritis. There seems to be no necessity for the "fasting diet," since the N.P.N. falls spontaneously as the condition improves (Fig. 2).

It may be objected that the ingestion of such quantities of protein in the early stage increases the likelihood of residual damage to the kidney. To meet this objection I shall briefly describe the subsequent fate of the cases discussed in this paper, the period of observation extending from January, 1931, to the present date. There have been 7 deaths, of which 2 were apparently a direct result of the nephritis and 5 were due to pneumonia or meningitis. Six patients were transferred to isolation hospitals or taken home by their parents; about these no facts are available. The remaining 85 attend hospital as out-patients and 55 show no evidence of renal disease. The other 30 have albuminuria of varying degree, 2 of them with moderate azotæmia and elevation of blood pressure. Some of these have not been long under observation, but earlier experience suggests that a substantial proportion will make a complete recovery. This recovery-rate compares well with others on record [4 5 6 15] and indicates that a diet containing an adequate quantity of protein is not an adverse influence.

SUMMARY

(1) Among 98 children suffering from acute nephritis azotæmia was found in 60 per cent. of those first examined within seven days of the onset, and in 51 per cent. of those first examined in the second week. (2) The degree of azotæmia bore no relation either to the amount of œdema or to the height of the blood pressure. (3) The non-protein nitrogen of the blood bore no relation to the incidence or the severity of the cerebral manifestations in acute nephritis. (4) A single observation of the non-protein nitrogen of the blood early in the disease is of no prognostic value. In this series persistence of azotæmia after the third week of illness is found to be of grave significance. (5) A sufficiency of protein in the diet does not militate against disappearance of azotæmia and has apparently no harmful effect.

I am indebted to Prof. G. B. Fleming, Dr. Stanley Graham, and Dr. Noah Morris for their help.

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AMOUNT OF HÆMOGLOBIN IN THE BLOOD

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In spite of the many investigations which have been made on blood the following statements can scarcely be disputed:—

1. The amount of hæmoglobin in a given volume of blood cannot be accurately estimated.
2. The percentage of hæmoglobin relative to a "normal" standard is accurate only for the apparatus employed, and differs widely with different instruments.

This paper attempts to survey critically the hæmoglobinometers in present use, and the methods by which they are standardised. A method of determining the relative amounts of hæmoglobin in different bloods, and suitable for routine use, is also described. It depends upon a physical property of oxyhæmoglobin the measure of which is permanent, capable of exact assessment, and of being used as a reference standard for other forms of hæmoglobinometer.

METHODS OF ESTIMATING HÆMOGLOBIN

For clinical purposes it has been customary to compare the colours of solutions of hæmoglobin or its derivatives in order to estimate the hæmoglobin concentrations. Less commonly the light transmitted by a solution has been measured electrically. The other methods available, namely, to find the oxygen-combining capacity, or the iron content, or the extinction coefficient at the head of the α or β bands, are too complicated for routine use, but have been employed in standardising the colorimetric or photo-electric hæmoglobinometers, and for research purposes. They will be discussed here only in relation to standardisation of hæmoglobinometers, though they are really more fundamental methods of estimating hæmoglobin.

1. *Colorimetric hæmoglobinometers.*—The large number of papers which are still appearing describing new hæmoglobinometers is an indication of the unsatisfactory position of the technique. The colorimetric methods have various degrees of refinement. They have the great practical advantage that a simple portable apparatus only is necessary. They enable a single observer who is optically sensitive to colour shades to compare one blood with another, with an accuracy which may be sufficient for clinical purposes. Unfortunately, everyone is not sensitive to slight colour differences, and moreover different results may be obtained with the same instrument by two observers each believing himself to be colour-sensitive. This makes colorimetric methods objectionable for routine work in a large hospital where there are several observers. That significant errors are thus introduced is shown in Fig. 1, where readings taken with the Dare colorimetric method, formerly in routine use in the Hale clinical laboratory, are compared with a method to be described later. Colorimetric readings have the further disadvantage that, while differences in colour shade are easy to read in the lower parts of the scale, they are obscure in the higher parts, where a slight difference of shade represents an appreciable range of hæmoglobin concentration. They are also difficult to make in artificial light and in the presence of bilirubin. It is difficult, if not impossible, to compare colorimetric results from different laboratories for the above reasons, and also because there are also wide differences between the "normal" standard of instruments of various types.

2. *Physical instruments.*—Spectrographic methods were used for estimation of hæmoglobin concentrations at the end of the last century, although the instruments were crude, compared with the modern spectrophotometer. In recent years, photo-electric methods of measuring the light transmission through hæmoglobin solutions have been elaborated, as for example by Davis, Sheard, Sanford, and Osterberg.[1-5] These instruments have a great advantage over the colorimetric ones in that there is no personal factor, but they are usually more bulky and more expensive. There is no question as to their superiority for both routine and research work. The photo-electric hæmoglobinometer in routine use in the Hale laboratory is described in detail at the end of the paper. It differs from that of Sheard and Sanford in that use is made of the intense Soret absorption band on the border of the ultra-violet instead of the better known α and β bands.

STANDARDISATION OF HÆMOGLOBINOMETERS

(*a*) *General.*—Whichever hæmoglobinometer is used, a figure is obtained which is some function of the amount of hæmoglobin in the blood examined, and each type of instrument has to be standardised.

Ideally a hæmoglobinometer should be standardised on hæmoglobin solutions, made from known weights of pure dry human hæmoglobin crystals. Hæmoglobin crystals are difficult to prepare from any blood, and have only recently been reported as made from human blood.[6] Pure dilute hæmoglobin solutions can be made from blood, especially if low temperature rooms are available, but they are unstable. The ideal method of standardisation is therefore a counsel of perfection, at present impracticable.

(*b*) *Chemical methods of standardisation.*—The chemical methods which are available are two: to determine the iron content, or to find the oxygen-combining capacity. It may be taken that a solution of hæmoglobin, completely saturated with oxygen, contains as many atoms of iron as it does molecules of oxygen, although it is not known how the oxygen is attached.[7]

There appear to be two forms of hæmoglobin in normal human blood,[8] and it is an assumption that the relation between colour and oxygen-capacity of

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both are identical. The number of iron atoms per molecule of hæmoglobin is probably four; it was formerly thought to be one. The iron estimation has not been in common use for the estimation of hæmoglobin in blood, partly because there is iron in blood in other forms, although in small amounts. It has not often been used for pure hæmoglobin solutions as the analysis was until recently thought to be technically more difficult and less accurate than the oxygen capacity. But recently Alt [8] has compared the estimation of hæmoglobin from blood iron analyses with the Sahli, Newcomer, and Dare colorimetric methods; Brown and Briggs [9] have compared the estimation of hæmoglobin by iron and by oxygen analyses; Haden [10] and Dowden and McNeill [11] have also shown that iron estimations in blood are reliable, and advocate strongly their use for hæmoglobinometry. The above authors all use either the modified Wong [12] method, or Kennedy's [13] method. Either can be completed in 15 minutes, and the latter method does not require continuous attention during that time.

The oxygen-capacity can be measured by the Barcroft, Haldane, or Van Slyke methods. All these depend on the interaction between oxyhæmoglobin and potassium ferricyanide, for which no chemical equation can be written. It has been shown that the oxygen is liberated *almost* quantitatively. But in blood the potassium ferricyanide reacts to a slight extent with other substances besides oxyhæmoglobin and also if the freed oxygen is left in contact with the reactants some of it is reabsorbed.[15–20] In the Barcroft and Haldane methods the oxygen is liberated into an air space at atmospheric pressure, and several minutes are allowed for equalisation of temperature before a reading of volume is taken. In the Van Slyke apparatus the reactants are very vigorously shaken for three minutes, and the gas is liberated into a vacuum. Its volume at constant pressure, or its pressure at constant volume, is then read as soon as the experience of the observer allows. Each of these methods gives reproducible results in the hands of an expert. The Van Slyke method tends to give the highest readings, and the Barcroft the lowest. It has been questioned whether the differences between the Van Slyke and Haldane methods are statistically significant.[21] It seems impossible to say which figure represents the true oxygen-combining capacity of the hæmoglobin in the blood. An added difficulty occurs when purified hæmoglobin solutions are used, as these very readily form methæmoglobin from part of the oxyhæmoglobin, and in this molecular rearrangement the oxygen is not freed by potassium ferricyanide. This introduces an error which is common to all three methods.

(*c*) *Physical method of standardisation.*—Hæmoglobin solutions may be compared by their extinction coefficients. The light, of a given wave-length, absorbed by a solution is related to the concentration and the thickness of the absorbing layer. By means of a spectrophotometer one can measure the relative intensities of the incident light (I) and the transmitted light (I′) for a given solution.

This ratio is related to the concentration (c) and the thickness (d) by the equation

$$\log_{10}\frac{I}{I'} = Ecd$$

where E, the extinction coefficient, is a constant for the substance in solution. This is known as Beer's law. It implies that log I/I′ is proportional to the product of the concentration and thickness of the solution, and that if the thickness be kept constant then the extinction coefficient will be proportional to the concentration. Provided that Beer's law is obeyed the extinction coefficient is a reliable constant. Newcomer [22] and Butterfield [23] have shown that the law holds for oxyhæmoglobin solutions for dilutions from 1 : 1 to 1 : 2000. We have confirmed the law over the range 1 : 100 to 1 : 5000.

Modern methods of measuring extinction coefficient are accurate to within ±2 per cent.[24] and results obtained with various instruments of different make and design agree very well with one another. From these considerations the extinction coefficient seems, at present, to be a reliable and universally reproducible standard for the standardisation of hæmoglobinometers.

METHODS OF EXPRESSING RESULTS

The amount of hæmoglobin estimated may be expressed either as the number of grammes in 100 c.cm. of blood, or as a percentage of the amount present in a "normal" individual. Both courses present difficulties.

A. *Hb. as grammes per cent.*—It is admittedly desirable, as some American workers [25–28] have recently emphasised, that the results should be expressed in terms of grammes of hæmoglobin per 100 c.cm. This, however, is not yet possible. To attempt to do so would, in our opinion, imply a false degree of accuracy. Peters and Van Slyke [29] are also of this opinion. They state: "The maximum volume of oxygen combining with 1 g. of hæmoglobin is a value concerning which we have, for human hæmoglobin, no reliable data."

In expressing hæmoglobin concentration in grammes per cent. it has been customary to use the figures given by Hüfner [30] in 1894. He stated that 1 g. of oxyhæmoglobin combines with 1·338 c.cm. of oxygen at normal temperature and pressure, and contains 0·336 per cent. Fe. With these factors the standardisation of hæmoglobinometers by chemical analysis has been translated into grammes of hæmoglobin per 100 c.cm. This has involved two assumptions. First, that Hüfner's figures are correct, and second, that the values are the same for ox and human hæmoglobins. Hüfner's paper is in a journal which is perhaps not easily accessible, and cannot have been widely read. His figures were obtained in the following way.

He assumed that the oxygen capacity was equal to the CO capacity. He separated corpuscles from plasma and diluted them with 0·1 per cent. NaOH to four times the volume of the blood from which they were obtained. He reduced the oxyhæmoglobin completely by letting it stand overnight with hydrazine hydrate. The N_2 which was evolved in the reaction was removed by suction for 6 hours with a filter pump. The flask of reduced hæmoglobin was then attached to a vessel containing pure CO and a manometer, and the change of gas volume due to absorption of CO was measured. The amount of hæmoglobin in the solution was then estimated spectrophotometrically (in 1894!) by finding the extinction coefficient of a solution made from dry hæmoglobin crystals prepared from ox blood. Eight solutions were analysed in this way, 6–10 readings being taken of each. A correction had to be applied for dissolved CO. An attempt was made to do analogous experiments on solutions of hæmoglobin crystals, but very discordant results were obtained. This Hüfner attributed to the difficulty of getting the crystals alcohol-free, but it may have been due to the instability of pure hæmoglobin solutions, which has been found by later workers and has prevented them from repeating his work.

It is obvious that Hüfner's method of determining the oxygen-capacity cannot be compared with current methods. The figure he obtained, however, was

confirmed by that calculated from iron analyses on ox hæmoglobin crystals, one preparation being analysed by himself and another by Jaquet in Basle. The crystals were dried to constant weight, ashed in a muffle oven, redried and titrated with potassium permanganate. Haldane [31] did not place any reliance on Hüfner's figures. He pointed out that the results of individual experiments differed by 10 per cent.; he thought the method theoretically objectionable, and the arbitrary correction which was applied for dissolved CO of questionable accuracy and of important magnitude. Later, Hüfner tried the ferricyanide method, and found results at least 13 per cent. lower than he had obtained by his previous method.

It will be seen that the "Hüfner factor" of 1·34 cannot be considered a satisfactory standard on which to base calculations for the conversion of oxygen-capacity determinations by Van Slyke, Haldane, or Barcroft methods into grammes of hæmoglobin per 100 c.cm.

B. *Hb. as per cent. normal.*—The "normal" hæmoglobin has been reported by many observers, using various hæmoglobinometers, variously standardised. Some of the data have been summarised into a diagram by Peters and Van Slyke.[32] The large variation among normals is probably not due merely to differences in method and observer. There is also a change with age and difference with sex. There has been much discussion on the supposed differences between English and American bloods in regard to hæmoglobin concentration. The 100 per cent. of the Haldane hæmoglobinometer is based on the estimations of Haldane and Smith,[33 34] which show that the mean percentage oxygen-capacity of 14 "normal" English individuals was 18·5 c.cm. per 100 c.cm. blood. The figures obtained varied between 16·0 and 20·9 c.cm. and sex or ages are not stated. They were obtained by making the subjects breathe a known volume of pure CO, and then estimating colorimetrically the percentage of CO in their blood. Hence the amount of blood could be calculated, and also the amount of CO, or oxygen, which would be necessary to saturate it completely, and the oxygen capacity per 100 c.cm. Here again the method used to find this "standard" figure is not one which is in modern use. Haldane [34] confirmed the figure later on 12 males, between 16 and 62 years of age, using the ferricyanide method.

Using the Haldane hæmoglobinometer Price-Jones [21] has found the mean of 100 male students in London to be 105 per cent., and that of 20 male students in Boston, U.S.A., using the same instrument, 112 per cent. The only difference in his experiments in the two places seems to have been that in England capillary blood was used from an ear-prick, while in America venous blood was used as more than one analysis was made on each sample. Oxygen-capacities were determined on the samples used by Price-Jones in America by the Van Slyke method in Dr. Dill's laboratory, and by the Haldane method by G. P. Wright. It will be noticed that the number of American students examined was small.

Price-Jones and Vaughan [35] have recently determined the hæmoglobin value of venous and capillary blood in 90 normal English males, using Haldane's colorimeter method. There was no significant difference between the hæmoglobin values for venous and capillary blood. The mean value for venous hæmoglobin was 105·46 per cent.; the possible limits of normal calculated as + and − three times the standard deviation were 120·44 per cent. to 90·48 per cent. These estimations were made by Vaughan using her own apparatus, including pipettes calibrated by one of us (P. M. T. K.), and the figures are in striking accord with the earlier series of Price-Jones in London. In order to establish the accuracy of the method as employed by Vaughan ten consecutive estimations were made on the same sample of blood. The mean obtained was 102·4 per cent. ± 0·18 per cent. The standard deviation was 0·8 per cent. ± 0·12 per cent. and the variability was 0·78 per cent. ± 0·12 per cent. In America the "normal" is usually taken to be 20·9 vols.[36] oxygen per 100 vols. or 15·6 g. Hb. per 100 c.cm. using Hüfner's figure, and this corresponds to about 114 per cent. on Haldane's scale. Sokhey,[37] using the Van Slyke oxygen method, found that the mean of 121 Indian males in Bombay was 111·3 per cent. Haldane. Jenkins,[38] in Salford, found a normal of 115 per cent. Haldane in a study of 53 males with a flicker hæmoglobinometer. Jenkins and Don,[39] using a Van Slyke constant pressure apparatus for oxygen determinations, tested bloods sent from London, Cambridge, Liverpool, Sheffield, Salford, and Altrincham, and found the mean to be 115 per cent. Haldane for 118 males, and 100 per cent. for 116 females. The figures ranged from 100–138 per cent. for males and 75–123 per cent. for females. It may be objected to this work that the samples were sent from far to be tested, and that the delay may have caused changes. Whitby and Hynes [40] found the mean Hb. of 50 normal London males to be 112 per cent., standard deviation 7·3 per cent., variability 6·5 per cent., limits 100–126 per cent., using the Haldane method. It seems unwise to conclude that there is a fundamental difference between English and American bloods while the techniques are still so difficult and the normal is so variable.

DISCUSSION

From the foregoing considerations it is clear that there is a great need for some basis of standardisation of hæmoglobinometers which would render hæmoglobin values wherever and however measured capable of direct comparison.

Obviously the most satisfactory means of standardisation would be afforded by known concentrations of pure hæmoglobin. As this is not yet practicable, recourse has to be made to certain chemical and physical constants of hæmoglobin. Iron content and "extinction coefficient" at the head of one of the absorption bands of hæmoglobin are the most reliable and easily determined constants of hæmoglobin.

At the time we standardised our hæmoglobinometer the methods for determining iron were laborious and of doubtful accuracy, as mentioned above, and, having means for measuring the "extinction coefficient," we calibrated the hæmoglobinometer here described, using this constant as a basis. If, therefore, at any time pure solutions of hæmoglobin become available it will be possible to relate the "extinction coefficient" measured on such a solution directly to the concentration of hæmoglobin, and by that means refer the hæmoglobinometer readings to concentrations of hæmoglobin.

The question of normality is of secondary and local importance. As Haden suggests, it should be determined for each particular laboratory or locality. In our case we have taken the mean of 70 values obtained from members of the London Hospital staff and students as the "normal." Fifty of these cases were also very kindly measured by Dr. Janet Vaughan, using the Haldane method. From these

cases we find that our normal corresponds with 105·5 per cent. on the Haldane scale with a standard deviation of 2·84 per cent. (Fig. 1).

The normal value has been translated into terms of extinction coefficient by parallel determinations with the photo-electric hæmoglobinometer and a Hilger quartz spectrograph with "Spekka" photometer on the blood of forty-two subjects whose blood varied in hæmoglobin concentration from 20 to 120 per cent. of the normal value. The details are given below.

We find that our "normal" corresponds with an extinction coefficient at λ 412·5 mμ of $1{\cdot}20 \times 10^3$ for a thickness of layer of 1 cm., from which can be calculated the fact that the Haldane normal corresponds to an extinction coefficient of $1{\cdot}14 \times 10^3$.

DETAILS OF PHOTO-ELECTRIC APPARATUS

The apparatus was designed for routine use in the London Hospital where 40–50 hæmoglobin estimations are made each day. It was therefore primarily required to be simple to work, rapid and accurate in the hands of the unskilled observer, and to be free from any variations which might require it to be continually tested or recalibrated. The question of portability did not arise as all determinations could quite easily be made in the laboratory where the instrument is permanently housed in a cupboard. The electrical circuit, which is standard practice, was chosen for its accuracy and simplicity. A 0·5 megohm resistance (R_1) is connected in series with a potassium vacuum photo-electric cell and with a 36 volt battery which supplied the accelerating potential. The potential difference across R_1 is proportional to the photo-electric current. This potential difference is measured by means of a slide-wire potentiometer and sensitive galvanometer connected as shown in the diagram (Fig. 2).

Of the three characteristic absorption bands of hæmoglobin the "Soret" band at λ 412·5 mμ was chosen for measurement for the following reasons: (*a*) The absorption of the Soret band is seven times more intense than that of either the *a* or *β* visible bands. This allows of measurement on volumes of blood which can be obtained from pin-prick samples 5 to 10 c.mm. (*b*) The Soret band is well separated from any other band. (*c*) Owing to its greater intensity errors introduced by pigments other than hæmoglobin—e.g., bile-pigments—are insignificant (<1 per cent.).

This region of the spectrum was isolated by two superimposed Wratten filters (Nos. 35D and 47). The light source is a 36 watt 12 volt car lamp which is run off accumulators. These are charged at a rate which is ½ ampere less than that taken by the lamp. In this way a steady light can be maintained (variation 0·5 per cent.) for an hour or two and all sudden fluctuations of the mains are eliminated. A circular flask, filled with water, absorbs heat rays and causes a roughly parallel beam of light to fall on the cathode of the photo-electric cell. It is usual in such an arrangement to hold the solution to be measured in a container, with parallel sides, the light traversing the cell horizontally. The cell may be open, the solution being pipetted in from above, or completely closed, the cell being filled and then one of the transparent faces applied and clamped. Both these methods require that the two faces of the cell should be parallel and that the dilution of the blood should be accurate. This necessitates (1) an expensive cell, (2) accurate measurement of blood volume, (3) accurate measurement of volume of diluting fluid. We have avoided (1) and (3) by reflecting the light beam so that it passes vertically upwards through the containing cell. This allows of having a cell with only one transparent face (at the bottom). In such an arrangement what will determine the amount of light absorbed is the total quantity of hæmoglobin in the container; if the light beam were truly parallel the absorption should theoretically remain constant whatever the dilution, provided that the amount of hæmoglobin in the cell remains constant and the light beam occupies the whole cross-section of the cell. We have attempted to fulfil these conditions in the apparatus. The containing cells, of which we have 20, are accurately bored to the same diameter and are made from some inert material. Discs are cut from first quality plate-glass and can be fixed at the lower end by means of a screwed ring. It is essential that all the hæmoglobin present should be fully oxygenated. We have assumed that with the dilutions we use (1:500) there is sufficient dissolved oxygen in the diluting fluid to ensure the saturation of the hæmoglobin in 10 c.mm. of blood.

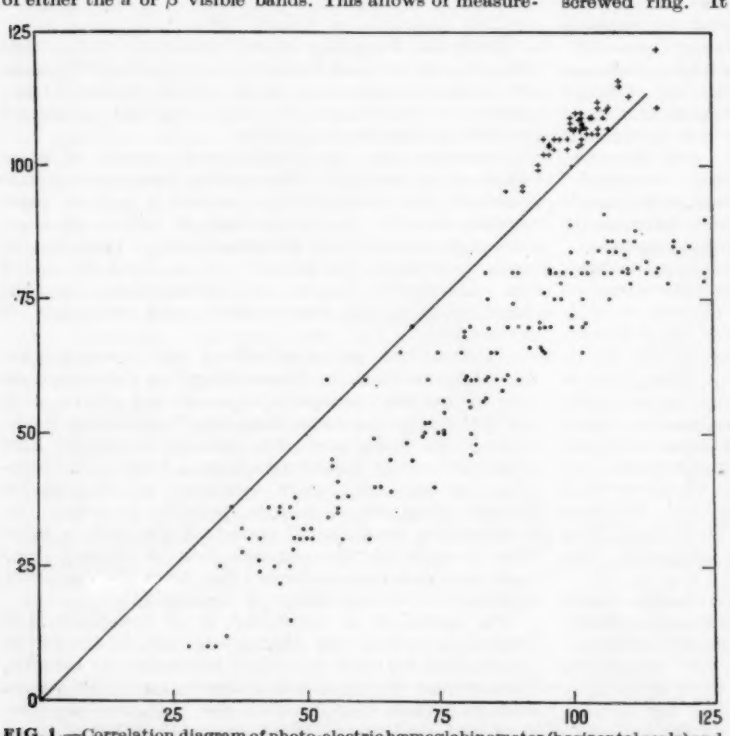

FIG. 1.—Correlation diagram of photo-electric hæmoglobinometer (horizontal scale) and Dare and Haldane hæmoglobinometers (vertical scale). Dots = Dare. Crosses = Haldane. The values express per cent. of "normal." All points would fall on the diagonal if all the three instruments gave the same values for particular blood samples.

PROCEDURE

The cells after cleaning are assembled, and into each are pipetted 5 c.cm. of 0·1 per cent. sodium chloride solution. This need only be a rough measurement. We have found that this diluting fluid gives us the most stable solutions of hæmoglobin, the usual alkaline fluids causing continuous and gradual conversion of the hæmoglobin to alkaline hæmatin. The strength we have chosen is such that the blood is completely hæmolysed and yet prevents precipitation of euglobulin. Each cell is covered with a lid. They are taken in batches of 10 to 15 into the wards. From an ear-prick 10 c.mm. of blood pipetted into one of the cells and the solution stirred once or twice with the pipette. The hæmoglobin should be determined within the next three hours. The light source and charging current are switched on about 10 minutes before measurements are to be made. After this time has elapsed the instrument is standardised as follows.

A slide is provided which holds a cell containing the hæmoglobin solution, and also an aperture closed with a piece of signal green glass, of known light-absorbing power. The slide is

moved so that the glass is in the light beam. The potentiometer pointer is brought to the mark "standard." The galvanometer is brought to zero reading by a coarse resistance R_2 (Fig. 2) and a fine resistance R_3. The slide is now moved bringing the hæmoglobin into the light beam, then the galvanometer

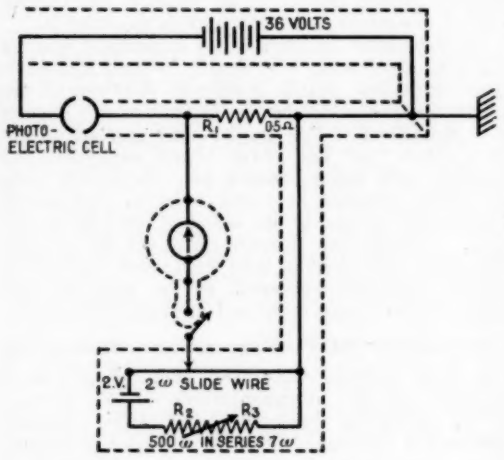

FIG. 2.—Plan of circuit.

is brought to zero by adjusting the potentiometer. The reading of the potentiometer when read off against a calibration curve gives the hæmoglobin percentage of the blood. The procedure takes about 10 seconds. We usually make two or three readings.

CALIBRATION

The instrument is calibrated against values of extinction coefficient (measured on a Hilger quartz spectrograph (medium) with a spectrophotometer) for a series of 42 bloods. For each blood 4 dilutions were made and these measured both on the spectrograph and on the hæmoglobinometer.

In this way a curve was drawn through about 150 points relating hæmoglobinometer reading to "extinction coefficient." The standard deviation of points from the mean curve was found to be 0·25 scale divisions of the potentiometer for the whole curve. It is less for the weaker bloods and increases slightly for more concentrated bloods. In terms of hæmoglobin value it corresponds to a standard deviation of 0·1 per cent. for a 20 per cent. normal blood, 0·7 per cent. for a normal blood, and 2·0 per cent. for a 150 per cent. normal blood.

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OLD "LABORATORY" STRAINS OF THE POLYMORPHIC TRYPANOSOMES

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In a recent paper on the chemotherapeutic susceptibility of trypanosomes, Browning and Gulbransen [1] describe a strain of *Trypanosoma brucei*, maintained in mice, as being at first "imperfectly accommodated" to this species of vertebrate host. During the early phases of its career in these little animals the trypanosome was found to be relatively resistant to various trypanocidal drugs. Later on, the strain became "highly accommodated and its pathogenicity increased to a maximum" and then the infected mice were readily cured with these same drugs. This description has suggested a few reflections from a different biological viewpoint, from one whose experience of these trypanosomes has been derived from strains freshly isolated from their natural environment in the tsetse areas of Central Africa.

Among the changes that may occur in trypanosomes during prolonged maintenance by direct passage in laboratory rodents two are of special importance. One is loss of the power to develop in tsetse, and the other is increase in virulence. A third character which may also change is pathogenicity to man.

TRANSMISSIBILITY TO THE TSETSE

The first phenomenon can only be demonstrated when clean tsetse are available in adequate numbers, and has been hitherto almost entirely overlooked in the routine evaluation of the characters of strains kept up in European laboratories. If, however, as indeed appears certain, *T. gambiense*, *T. rhodesiense*, and *T. brucei*, are essentially dependent on tsetse for their survival in nature, surely one of the most important of their many characters is the power to develop cyclically in the fly? Once a strain has lost this quality it retains for the student of human trypanosomiasis an interest mainly academic. There is good reason to believe that many old laboratory strains are actually unable to develop in glossina.

It is remarkable how completely this property of

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transmissibility has been ignored by most investigators of the polymorphic trypanosomes. At Hamburg, Reichenow and his colleagues have studied what appears to be a closely associated if not identical character, the culturability of these organisms in artificial media. Otherwise no one has yet attempted seriously to examine the accuracy of the conclusions reached on this subject in Uganda during the last ten years.

It seems to me probable from a careful study of Taylor's admirable work in Nigeria [2] that there were actually one or two non-transmissible strains among those under his purview. His main objective, however, led him in other directions and the opportunity has not recurred. In his introductory remarks Taylor thus refers to my views: "If this total loss of transmissibility occurs in nature with any frequency, and Duke's analysis of East African *T. gambiense* strains suggests this, then it would seem that *T. gambiense* strains are constantly becoming extinct, a conclusion of very considerable importance from the epidemiological standpoint."

My own experience of naturally occurring non-transmissible strains has been derived entirely from *T. gambiense* regions in Uganda and the Belgian Congo where *Glossina palpalis* is the only tsetse. Even here they were exceptional, and to demonstrate satisfactorily this peculiarity in the laboratory demands of course the dissection of large numbers of tsetse. I have met with only one non-transmissible "wild" strain of *T. brucei*, and none of *T. rhodesiense* in its typical form virulent to man.

VIRULENCE

The second modification, increasing virulence, may occur in nature. It is possible that direct transmission by glossina plays an accessory part in the spread of the *brucei* group in nature, in the form of epidemics in man or domestic animals. But an event of this kind is incidental to the normal propagation of these trypanosomes. In nature increasing virulence for a vertebrate host is actually an embarrassment to a trypanosome, and yet in the laboratory there is a tendency to regard it rather as a kind of adaptation of the parasite to its host.

An enormous amount of work has been carried out with trypanosomes in European laboratories during the last 20–30 years. Many of the strains used have been atypical derivatives from originals isolated many years previously, and although retaining little or nothing in common with their forebears save a general morphological resemblance, the old specific names are used. Thus we hear of strains of *T. brucei* killing rats in a few days, and stranger still, of a lethal *T. gambiense* that disposed of mice in 2–3 days. Clearly there is little resemblance between such strains and their ancestors fresh from human or ruminant blood; and it is not to be wondered at if confusion has arisen from the continued use of well-known specific names for these curiosities of the laboratory.

It has long been known that a strain of trypanosomes may change materially and sometimes quite quickly when once it is introduced into laboratory rodents. The normal vertebrate hosts of all the tsetse-carried trypanosomes possess one feature in common—namely, a considerable resistance against the protozoon. It is plainly in the interest of the parasite to do as little harm as possible to its host. For example, man's susceptibility to *T. rhodesiense* suggests that he should not be regarded as a natural host of this trypanosome. In nature, until perhaps recent years, it is unlikely that he is of more than secondary importance as a host. In uncivilised Africa, when *T. rhodesiense* invaded a human community man either disappeared or the parasite gradually adjusted itself by assuming a mild *T. gambiense* form, in which it had a chance of survival. A wild vertebrate as susceptible to *T. rhodesiense* as are the laboratory rodents would certainly be rapidly exterminated, even if the tsetse ever succeeded in reaching it.

Pathogenicity to man is an important character when we are dealing with freshly isolated strains from game or tsetse. But it is after all only one of many attributes possessed by a trypanosome. Moreover, it is possible that this quality may appear, de novo, in a strain that has never before parasitised man, together with other changes associated with upkeep by direct passage in small rodents. Exaggerated importance is apt to be assigned to infectivity to man. Are all the alleged instances of accidental laboratory infections of man with species of trypanosomes ordinarily supposed to be non-pathogenic, really due to carelessness and mixing of strains?

LABORATORY CHANGES AND TRYPANOCIDAL DRUGS

A field biologist may well look askance at the majority of the representatives of *T. gambiense* or *T. brucei* in European laboratories. Increased virulence is a common result of prolonged maintenance of a trypanosome in rats or mice. There is also evidence that the guinea-pig in course of time exerts a definite influence upon these organisms. Wallace and I found indications of this in Uganda, and Van Hoof and Henrard in the Congo. More recently I have found that both pathogenicity to man and transmissibility by tsetse may diminish apparently to vanishing-point on maintenance of a strain in guinea-pigs. Observations of this kind sound a warning note, and in investigations of transmissibility the guinea-pig should be avoided as far as possible.

It is of course interesting to determine how long old laboratory derivatives of the human trypanosomes can retain their power to infect man. But the interest is mainly academic. When once the strain has in other respects ceased to be a human parasite in the ordinary sense of the term. For instance, Reichenow's Hamburg strain of *T. gambiense*, isolated from an European in Fernando Po in 1920, was found in Uganda to be still infective to man by subcutaneous inoculation in June, 1935.[3] But this same strain had in the meantime become completely non-transmissible by tsetse (*G. morsitans* and *G. palpalis*). Yet another point. It is easy to make an old laboratory strain of say *T. brucei* resistant to drugs, and this resistance, as Yorke and his colleagues have shown, can be greatly enhanced without diminution on cyclical passage through glossina.

Certain strains of *T. gambiense*, on first isolation from man, also possess a considerable resistance to arsenic, and this resistance can presumably also easily be enhanced. It is sometimes assumed that such resistance has been acquired by contact in some earlier passage with arsenical drugs; but it is equally probable that it is a natural feature of certain strains. Typically, however, *T. gambiense* is readily sensitive to arsenic in therapeutic doses. It is therefore interesting to note that hitherto all attempts to make a really sensitive strain of *T. gambiense* arsenic-resistant have been attended by serious impairment of the transmissibility of the strain by tsetse. The new arsenic-fast variant could not, in other words, develop in the fly. Admittedly this has been observed so far only twice, once in Nigeria and once in Uganda. But it is a point that should be settled, and calls

for a study of fresh strains and the employment of tsetse. Obviously the development of drug resistance in ordinary arsenic-sensitive *T. gambiense* has no practical significance if at the same time the strains become non-transmissible by glossina.

And here we may digress for a moment on an issue of real importance. There is no denying the danger of producing by improper treatment of native suffering from trypanosomiasis in *G. palpalis* and *tachinoides* areas strains resistant to arsenic. Arsenical drugs are acknowledged as useless in the routine treatment of *T. brucei* or *T. rhodesiense* because both these forms are naturally resistant to therapeutic doses of these drugs. But where *T. gambiense* occurs in its typical form, arsenic is effective because most strains are sensitive to its action. *T. brucei*, *T. rhodesiense*, and *T. gambiense* are, however, all very closely related, and in regions where they all three occur there is likely to be a considerable range of arsenic resistance in the strains isolated from man, for we can no longer confidently believe in hard-and-fast divisions between these three so-called species. In practice the danger can be met, as it is in Uganda, by combining with arsenical treatment a dose or two of Bayer 205. But it may be that this is not the best method and that arsenicals with their attendant dangers should give place altogether to Bayer 205 and its equivalents.

And the moral behind all these reflections? Surely to abandon the study in laboratories the world over of ancient and atypical laboratory strains of the tsetse-carried trypanosomes, and take up in their place samples recently isolated from their natural habitat. Study these until they start degenerating and then scrap them, and so build up a first-hand knowledge of the trypanosomes as they really are in nature. At any rate keep the two classes separate from one another. There is no need to alter the existing nomenclature, but merely our attitude towards old laboratory strains.

One result will be fewer disappointments over the claims made for new trypanocidal drugs, when the time comes to test them out in real life. Among the routine tests applied to trypanosomes should be included, as all important, their behaviour in tsetse. And when once a strain has lost the power to use its normal vector it should no longer be regarded as a true representative of the species from which it was originally derived.

Let us keep the distinction clear between natural and laboratory strains of the pathogenic trypanosomes and exercise due caution in transferring conclusions from one to the other.

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CLINICAL AND LABORATORY NOTES

TUBERCULOSIS OF THE NASAL SINUSES TREATED BY IRRADIATION

By W. Annandale Troup, M.C., M.D. St. And.

The forms of irradiation I use in the treatment of sinusitis are: (1) infra-red rays applied locally over the affected antra and sinuses; (2) ultra-violet rays, applied both postnasally and intranasally, by means of quartz applicators attached to the Kromayer mercury-vapour lamp; and (3) ultra-violet rays applied to the whole body by the titanium-alloy arc. The effects arrived at are dilatation of the ostia; establishment of drainage from infected antra and sinuses; increased flow of blood and lymph to the affected areas; increased bactericidal properties in the mucus secretion; regeneration of the mucous membrane and restoration of its normal function; and increase of bodily resisting powers. Success depends on accurate dosage, since varying stimuli evoke varying responses in different cases.

The value of the method is illustrated by the following case.

A man, aged 30, a patient of Dr. E. R. Keeble, was sent to me by Sir Henry Martyn, of Windsor, and first seen on Oct. 8th, 1934. Sir Henry wrote: "Physical signs started in this man's chest when he was fifteen years of age, and were diagnosed as pulmonary phthisis. The symptoms improved and remained quiescent until this summer, when he again had a flare-up with a prolonged burst of temperature. There were physical signs at both bases and at the apex of the left lung. Signs were confirmed by X ray examination, but at no time have tubercle bacilli ever been found in the sputum. The case was referred to me concerning the possibility of sinus infection. Both his antra were dark on trans-illumination, and on washing them out a clear return was obtained from the right antrum, but a considerable mass of dark translucent white mucus from that on the left. Examination of the washout showed tubercle bacilli in large quantities."

On Sept. 25th the sinuses were examined by Dr. H. K. Graham-Hodgson, who reported that radiography showed polypi in both maxillary antra, and some thickening in the lining membrane of both frontal sinuses (more on right than on left) and of the anterior ethmoidal cells. The right posterior ethmoidal cells and the right sphenoidal sinus were radiologically normal. The left posterior ethmoidal cells and the left sphenoidal sinus showed marked thickening of the lining membranes.

The patient weighed 13 st. 7 lb., and his height was 6 ft. 6 in. He looked debilitated and toxic, and had been running an evening temperature up to 100° F. for three months during which time he had been confined to bed. The joy of life had departed and the mental outlook was without hope.

Irradiation began on Oct. 8th. On Oct. 11th the evening temperature was normal, and the nasal and postnasal discharge much increased. On the 15th his weight was 13 st. 10 lb.; all acute pain had disappeared, and he said that his face no longer felt like a blown-up balloon. On Oct. 24th there was no pain in the occipital region and he was feeling very much better. On the 29th he had gained a further 3 lb. and was able to stoop without giddiness or tightness in the head. On Nov. 5th his weight was 14 st. 2 lb., and Dr. Keeble reported that all active physical signs in the chest have disappeared; by the 11th the evening rise of temperature had altogether ceased; and on Dec. 3rd the weight was 14 st. 6½ lb.

Dr. Graham-Hodgson examined the patient again on Jan. 17th, 1935, and reported that the maxillary antra were now clear-cut and well defined, the opacities previously seen being almost absent. The cloudiness in the frontal sinus had also very largely disappeared. There was still some thickening in the lining membrane in the ethmoidal cells and sphenoidal sinuses, but it was less obvious than before.

On Jan. 22nd the patient was examined by Sir Henry Martyn and the antra washed out. The washings came back quite clear, the fluid was sterile, and no tubercle bacilli were found. By Feb. 21st the weight was 15 st., and on April 5th treatment was discontinued. Dr. Graham-Hodgson's final report stated that there was still some

slight cloudiness in the frontal sinus, but no X ray evidence of abnormality in either maxillary antra. There was also some thickening of the lining membranes in the anterior ethmoidal cells on both sides, but the posterior ethmoidal cells were radiologically normal. The lining membrane of the left sphenoidal sinus also showed very slight thickening. Sir Henry Martyn considered the patient fit to continue his duties, which he is now pursuing with greatly increased vigour and perfect health.

This patient had over 60 treatments in all, but it must be remembered that there was a history of over fifteen years, the infection was severe, and his state was drifting from bad to worse. I feel confident that with patience and perseverance many such cases now labelled "hopeless" could not only be relieved of their suffering but returned to the ranks of the healthy.

Sir Henry Martyn adds the following comment.

"The case is interesting both from the unusual character of the sinus infection and from the remarkable response to light therapy. As Dr. Watson-Williams has pointed out, it is common enough to meet with cases erroneously diagnosed as tuberculosis of the lungs, in which no tubercle bacilli have ever been found in the sputum, and which are, in reality, cases of chronic pyogenic infection of the sinuses, but it is certainly unusual to find the exact converse—a case of definite tuberculosis of the lungs, in which no tubercle bacilli had ever been recovered from the sputum, but in which they were present in large numbers in the sinuses. From the point of view of treatment the problem presented by such a case is serious in the extreme. To contemplate operative procedure with such extensive sinus involvement in a patient with advanced pulmonary damage would have been wholly unjustifiable. On the other hand, to anticipate that sanatorium treatment alone would be sufficient to allow a patient to overcome a sinus infection advanced to a degree of actual polypoid degeneration of mucous membrane appeared to be unduly optimistic. In light therapy we appear to have a weapon of the greatest value, and although it would be wrong to generalise upon a single case there would appear to be every justification for a more extended use of this method of treatment."

London.

FREE MELANIN-BEARING CELLS IN ASCITIC FLUID IN DIFFUSE MELANOMATOSIS

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A married woman, aged 53, was admitted to Mr. Edington's surgical ward in the Western Infirmary on July 18th, 1931. A pigmented mole was removed from the left hip. Histological examination showed this to be a melanoma. In August, 1933, she developed malaise, discomfort after food, and vomiting.

She was readmitted to Mr. Edington's ward on Sept. 6th. The abdomen was much swollen, and paracentesis yielded, on separate occasions, 280 and 396 ounces of clear ascitic fluid. On Nov. 13th she was transferred to the Southern General Hospital, where paracentesis of the abdomen was performed eleven times, a total of 111¾ pints being withdrawn. She died on June 18th, 1934.

The illness was marked by progressive and extreme emaciation, and latterly irregular masses were palpable in the upper quadrants of the abdomen. At times there were attacks of severe diarrhœa, but the stools showed no blood, pathogenic organisms, or excess of mucus. At no time was the urine abnormally dark in colour. There was no fever.

The unusual feature noted was the presence of free melanin-bearing cells in the ascitic fluid during the last eight paracenteses in the Southern General Hospital. This black material appeared during the last two pints to be withdrawn and increased in amount towards the end of the operation. Palpation of the abdomen greatly increased the quantity of melanin withdrawn.

Paracentesis was performed in the midline above the pubis, and melanotic tumours developed in the sites of the needle tracks. These were bluish-black, firm nodules, well raised above the skin level.

Dr. P. R. Peacock, of the Royal Cancer Hospital, examined the ascitic fluid and reported that such cells as were recognisable appeared to be endothelial cells or phagocytes, probably macrophages, containing pigment which masked their histological features. Two fowls inoculated intramuscularly showed no lesion during several weeks of observation.

At post-mortem examination by Dr. J. N. Wilson, the abdominal viscera were found to be jet black owing to the presence of very numerous melanotic tumours in the omentum, and were matted together. Small pigmented areas were seen in the stomach and small bowel, and parts of the wall of the stomach and small bowel had the consistency of cardboard. The peritoneum and omentum were covered with black nodules. The heart, lungs, kidney, liver, and spleen were not affected. Secondary deposits were found in several ribs, and the mediastinal glands and right submaxillary gland were involved.

Dr. F. E. Reynolds, pathologist to Stobhill Hospital, examined a skin transplantation tumour and reported: "The nodule is lined by a thin layer of epithelium in which there are few 'epithelial pegs'; the deeper cells do not contain an excess of pigment. The neoplasm consists of a number of 'islands' in the subepithelial tissue. One of these is situated in the tissue immediately below the surface epithelium and is not involving the latter structure. The other islands lie deeper. The neoplastic cells are for the most part large and polyhedral and contain a large amount of melanin in the form of fine granules. In certain portions, however, the cells are almost devoid of pigment. Again, examples of small rounded neoplastic cells occur. Both in and around the islands it is clearly demonstrated that local spread of the neoplasm has been along lymphatic vessels and spaces."

The post-mortem findings indicate that the melanoma spread from the left hip by way of the lymphatic vessels accompanying the veins, involving the hypogastric lymph glands first. The freedom from infection of the lungs, heart, kidneys, and spleen suggest that it was never blood-borne. The skin deposits at the site of puncture show local transplantation, which in turn initiated lymphatic extension.

The case is reported because of its rarity. Undoubtedly the intracellular melanin was derived from the peritoneal and omental tumours. In Kaufmann's "Pathology" (1922, p. 1699) it is stated that melanin may occur in transudates but I have found no clinical reference to such a condition published since the war. In a total of 492 cases reported by Boulay (191),[1] Coley and Hoguet (9),[2] Gleave, H. H. (40),[3] Dawson (120),[4] and Butterworth and Klauder (50)[5] no reference is made to it. Incidentally the primary lesion occurred in the lower extremities in 115 out of these 492 cases.

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REVIEWS AND NOTICES OF BOOKS

Disorders of the Blood

By LIONEL E. H. WHITBY, C.V.O., M.C., M.D. Cantab., F.R.C.P. Lond., D.P.H., Assistant Pathologist, the Bland-Sutton Institute of Pathology, Middlesex Hospital; and C. J. C. BRITTON, M.D. N.Z., Assistant Pathologist, Christchurch Hospital, New Zealand. London: J. and A. Churchill Ltd. 1935. Pp. 543. 21*s*.

IN selecting the title of this comprehensive monograph the authors desired to emphasise the rarity of primary disease of the hæmopoietic system and how often changes in the peripheral blood are a symptom of a disease or disorder in some other system of the body. The work contains descriptions of the blood picture to be found in almost all the diseases known to man, from the recognised anæmias and leukæmias to infections and miscellaneous conditions such as allergy, coronary thrombosis, and diabetes. The opening chapter contains a discussion of the origin, development, functions, and fate of the cells of the blood, following on the whole the views of Doan, Sabin, and Cunningham. Three chapters are devoted to the principles and practice of hæmatological diagnosis; the methods of studying red cells, leucocytes, platelets, and the physical and chemical properties of the plasma are discussed in detail with the interpretation to be placed on the results obtained. The causes of anæmia and the nature and mode of action of hæmopoietic substances are analysed, and an ætiological classification of the anæmias is set out. In subsequent chapters the anæmias are discussed under a more clinical grouping, such as the anæmias of pregnancy and the anæmias of infancy and childhood. In all cases an account of the clinical and hæmatological picture is supplied together with a discussion of the pathology, ætiology, diagnosis, and treatment. Though an admirable description of agranulocytic angina is included in the chapter on diseases due to aplasia or hypoplasia of the bone-marrow, the authors point out that in one group of cases at least marrow hyperplasia is characteristic, suggesting that maturation arrest is the fundamental pathology of the condition. In the chapter devoted to the leukæmias modern literature dealing with mononuclear leukæmia is surveyed. This variety of leukæmia is recognised more frequently in America than in Europe. Careful study of the section dealing with hæmo-agglutination and blood transfusion should do much to lessen the fatality from unsatisfactory transfusions. Each chapter is completed by a concise summary and a bibliography. All essential technical methods are fully described in the text, and throughout the monograph knowledge is clearly summarised and presented as far as possible in tabular form. The book is well illustrated with graphs and coloured plates both of macroscopic appearances of the bone-marrow and of blood films stained presumably by Leishman's stain though no indication of the method employed nor of the degree of magnification is given. The research worker in hæmatology may regret certain rather uncritical statements; for instance, in a discussion of the value of the reticulocyte count the unqualified remark that "if a reticulocyte crisis occurs it can be assumed that the treatment will be effective." Unfortunately work which was summarised in the special article by Minot and Castle which appeared in our columns last month [1] has shown that there are many non-specific substances such as arsenic and certain protein derivations which when given to patients with pernicious anæmia may cause an output of reticulocytes but no further rise in red cells or hæmoglobin; while the exact interpretation of the response in any case depends on a careful evaluation of many variable factors which are not discussed by Whitby and Britton.

This monograph should prove of great value to students and practitioners who need a concise summary of the ever-increasing literature on hæmatology, much of which is of immediate clinical importance. They will find in this work little unnecessary theory and much practical information set out clearly and succinctly.

[1] THE LANCET, August 10th, 1935, p. 319.

Radiological Atlas of Chronic Rheumatic Arthritis (Hand)

By S. GILBERT SCOTT, M.R.C.S., L.R.C.P., D.M.R. & E. Camb., Honorary Radiologist to the British Red Cross Clinic for Rheumatic Diseases, Regent's Park, and to the Charterhouse Rheumatism Clinic; Consulting Radiologist to the London Hospital. London: Humphrey Milford, Oxford University Press. 1935. Pp. 76. 30 plates. 25*s*.

THIS important monograph should pave the way to a better understanding and treatment of "rheumatism." Dr. Gilbert Scott makes no claim to be an authority on rheumatism, but after an exceptionally wide general experience he has in recent years studied with an open mind a wealth of clinical material passing through the British Red Cross rheumatism clinic and has drawn from this study conclusions of great practical value. All may not agree with him when he attributes the failure of workers in the past, notably Strangeways, to elucidate the problems of rheumatic conditions mainly to their unquestioning acceptance of the clinical diagnosis. There is much in his claim that the clinical diagnosis of these conditions is unreliable taken alone, and that the only accurate method of diagnosis is by the radiological examination, but most clinicians would maintain that both methods must be used together. Dr. Scott uses the hand as "the visiting card of the rheumatic patient." He classifies his cases on a radiological basis, and claims that nearly all fall under four well-defined headings. Doubtless this simple classification is open to criticism, but it serves its purpose and is, at least, a reasonable foundation. The 30 radiograms are, of course, so well reproduced as to show clearly the changes described.

Chronic Nasal Sinusitis and its Relation to Mental Disorder

By F. A. PICKWORTH, M.B., B.S. London: H. K. Lewis and Co., Ltd. 1935. Pp. 156. 16*s*.

THE first element in the title of this book receives much more attention than the second; it may indeed be questioned whether any essential connexion between the two follows from the evidence so laboriously collected and here so fully presented. The finding of sinusitis in patients who died in mental hospitals, often after many years of institutional life, cannot be taken as ætiologically significant in the absence of control data. Dr. Pickworth has an ingenious theory about the vascular happenings

which follow on chronic nasal sinusitis and are responsible for physical changes of the brain tissue. The earlier chapters of the book are devoted to the anatomical, physiological, and pathological basis for this view; there are then three chapters dealing, respectively, with nasal sinusitis in general medicine, the pathology of mental disorder and defect, and the relation of nasal sinusitis to cerebral pathology and mental disorder. Notes of special cases and some methods of investigation are appended. The detailed observations will be critically examined both by the rhinologist and the psychiatrist. The latter may find it difficult to agree that loss of brain substance from severe and prolonged functional ischæmia leads to a spreading of ungoverned nerve impulses and so to abnormal conduct, or that hysteria should be treated as a medical disease due to minute focal brain lesions. The illustrations in the book are from original specimens and well produced.

The Osteopathic Lesion

By GEORGE MACDONALD, M.B., Ch.B. Edin., D.O. Kirksville, U.S.A., and W. HARGRAVE-WILSON, D.O. London: William Heinemann Ltd. 1935. Pp. 141. 7*s.* 6*d.*

THIS book is of value as a contribution to the discussion of the claims of osteopathy, which have recently aroused so much public interest, in that the authors state precisely what they believe the osteopathic lesion to be. In order to make their meaning clearer they have chosen to concentrate upon an osteopathic lesion of the joints between the fifth and sixth dorsal vertebræ; they define the lesion as an acute or chronic joint strain which leads to local, peripheral, visceral, and general effects. Particular stress is laid upon the visceral changes which are supposed to be produced by nervous impulses arising in the neighbourhood of the strained joint, passing to the spinal cord, and reaching the viscera along sympathetic efferents—the so-called somatico-visceral reflex. They claim that Mackenzie's views on the viscero-motor reflexes harmonise with osteopathic theory, though they admit that in the reflex path which he described the impulses travelled in the opposite direction. It must also be remembered that Mackenzie was able to bring forward sound evidence that a viscus is capable of providing an adequate stimulus to excite the reflex, whereas the theory that a strained joint can provide a stimulus is conjectural, the authors' suggestion being that, "because of the popularity at the present moment of physiological chemistry and hydrogen-ion concentration in medical research," the possibility that biochemical changes in and around the osteopathic lesion may be of ætiological significance cannot be dismissed. They are satisfied, however, that it would be only reasonable, even without any evidence, to assume that it is possible for a joint strain to give rise to such reflex effects in the viscera, and they go so far as to hint that the areas of tenderness over the dorsal spine described by Mackenzie in cases of gastric disease were in reality the local evidence of the osteopathic lesion to which the changes in the stomach were secondary.

Dr. Macdonald and his collaborator state that the anatomy, physiology, and all the basic sciences taught in osteopathic institutions are exactly the same as those taught in medical institutions. Though this may be so, there are certainly profound differences between these sciences as taught in the medical schools and the references to them which appear in this book. It would be difficult, for instance, to explain on physiological grounds the close relationship between the cilio-spinal centre and the centre of life, or why a sense of general well-being should depend upon the integrity of the second dorsal segment, or why the proximity of the spinal muscles to the central nervous system should account for the particularly marked tension of these muscles which is alleged to result from mental anxiety. The statement that it may well be an osteopathic lesion of the upper dorsal spine which predisposes the upper lobe of the lung to tuberculous infection is scarcely to be taken seriously when one reads in the next sentence that a large number of suspected tuberculous infections of the lungs prove on radiological examination to be nothing more than upper dorsal scoliosis.

The alleged effects of the osteopathic lesion are traced step by step from disturbances of the neighbouring organs to malfunction of the ductless glands and to reduction of the general resistance of the body to infection, and finally we are guided to the inevitable conclusion that the great possibilities of osteopathy lie in preventive medicine, though it is admitted that there are a few diseases which are sufficiently potent in themselves to cause illness even in an osteopathically sound body. Such extravagant ideas do not pervade the whole book, which is characterised rather by the modesty of the claims made by the authors for the healing power of osteopathic manipulation. They consider that this form of treatment is not suitable for cases of established disease, but that it is indicated particularly when symptoms are due merely to some disturbance of visceral function, or to neurasthenia and nervous exhaustion. It is a book which should be read by any medical man who wishes to judge for himself whether the osteopathic concept is founded on scientific fact.

Dorland's Medical Dictionary

The American Illustrated Medical Dictionary. Seventeenth edition. By W. A. NEWMAN DORLAND, M.D., F.A.C.S. With the collaboration of E. C. L. MILLER, M.D. Lond. London: W. B. Saunders Co., Ltd. 1935. Pp. 1573. 30*s.*, or with thumb index, 32*s.* 6*d.*

IT is not three years since we reviewed the sixteenth edition of this dictionary. The preface tells us that during this time a large corps of collaborators have scrutinised every page, editing the whole matter and adding several thousand new definitions. There are 80 more pages, but the bulk of the volume is certainly not greater and the price is 5*s.* less. It is hardly necessary to tell our readers about the contents of so well known a volume; its completeness is such that it is now something like a treasure hunt to find any missing words. But Dorland still knows nothing of the Higginson who invented a syringe, although we can now find Peter Chamberlen who invented the forceps; there is a convenient single word to express the belief that the world exists only in the mind of the philosophising individual and that word is not in Dorland. The second initial of the Swedish physiologist whose memory is perpetuated in the wool test is not C., the name is Frithiof. But the other minutiæ we had reserved for this occasion have been picked up in the really admirable revision. We would only ask the editors what has happened to the x of thorax in the word "thoracentesis," and whether the portrait on p. 620 is that of Wilhelm His senior or junior. The dictionary, as we have said before, is a masterpiece of legible compression.

THE LANCET

LONDON: SATURDAY, SEPTEMBER 21, 1935

A HOSPITAL INSURANCE SYSTEM

No better start can be offered to a gathering of professional men of widely different outlook, habitat, and experience than a provocative address covering interests common to them all. During the course of his survey of hospital problems, published in last week's *British Medical Journal*, Sir JAMES BARRETT gave to well-worn themes a new orientation, and to prickly issues that firm grasp which mitigates the effect of their sting from a painful eruption to a mild titillation by no means disagreeable. It is not customary for the British Medical Association to discuss in public the president's address, but one can imagine the members congregating in small groups as they left the Melbourne Town Hall eagerly debating such questions as the source of capital and revenue of hospitals in different parts of the Empire; the optimal size of hospitals anywhere; the remuneration of the medical staff—whether in prestige and experience, or in cash; the widespread exploitation of student labour in the routine nursing of hospital patients; and the far-reaching development of contributory schemes in Victoria during the last 25 years. It was with an account of this last adventure in hospital insurance systems that Sir JAMES opened his survey, and it is not unreasonable to suppose that its success has influenced his outlook on the economics of hospital provision elsewhere.

It appears that in 1911, under the auspices of the Victoria Bush Nursing Association, one trained nurse was established after many difficulties at Beech Forest, the residents undertaking to pay her salary. In two years' time there were 13 such nurses. At first the money for their salaries was raised by local subscription, but the varying amounts contributed by residents caused trouble, and it was decided that all contributors should pay the same sum and should be entitled to nursing care at need without further charge. Next came the problem of housing the nurses, and it was found that the privacy and convenience of both nurse and patient was best assured by the renting of small cottages for this purpose. The supervision of centres great distances apart became impossible as an honorary service, and in 1913 a superintendent was appointed with the aid of the Walter and Eliza Hall trust. The movement grew until in 1921 there were 33 centres; then small cottage hospitals began to be established by generous benefactors, and to these were transferred the payments under the contributory scheme for nursing. Contributors became entitled to hospital and nursing attention for themselves and their dependants up to a certain age, at the cost of about £2 2*s*. per week over and above their annual subscriptions, making their own arrangements with their medical attendants. In 1926 the Edward Wilson trust decided to establish an ambulance service on a similar basis to the nursing association—that is, to be self-supporting after the initial gift. Now, in 1935, there are in Victoria—a State with an area of 88,000 square miles and a population of 1,800,000—69 centres maintained on a contributory basis, served by 22 ambulances; 45 of the centres are hospitals with an aggregate of 416 beds. These hospitals receive no State aid for construction or, except in six special cases, for maintenance. They must maintain themselves or close; and so far none has closed. They are staffed entirely by well-paid trained nurses, and are said by Sir JAMES BARRETT to provide the cheapest hospital accommodation in the State. He claims that a great improvement in medical practice has resulted from the provision of suitable buildings and highly trained nurses in country districts. It is noteworthy that all the doctors who treat patients in these hospitals become ex-officio members of the committee of management, and that the hospitals, in addition to their usual functions, provide centres for welfare work and for the medical inspection of school-children. The system works smoothly and efficiently.

Far less satisfactory from the financial point of view is the position of the so-called public hospitals in Victoria. These are maintained by voluntary contributions, by Government subsidy, and by patients' contributions, but are not under direct Government control, being administered by honorary committees. Up to about 1900 this arrangement is said to have worked tolerably well but since then conditions have changed. The total income from all sources has increased fourfold but has, of course, been matched by the expenditure. The number of patients desiring treatment has increased nearly fivefold, though the population of the State is only about 50 per cent. greater than it was. In 1900 the number of patients treated by public hospitals was 7·2 per cent. of the population; in 1934 it was 17·4 per cent. Sir JAMES BARRETT holds strongly that the main problem of finding and financing hospital beds in sufficient numbers arises from the fact that the sick population of every class has become more hospital-minded. It is with the future of these public hospitals that his address is largely concerned. His bias is clearly towards their maintenance as far as possible on a voluntary basis, aided by Government subsidy but managed as hitherto by honorary committees. Some of the arguments wherewith he supports his thesis may require closer examination, but they lead him to such interesting by-ways that none will reproach him for straying from the strictly logical path. Our own quarrel would be not so much with the deduction he draws from premises not always clearly stated as with any attempt to discuss such problems as the optimal size of a hospital from the purely financial aspect. This is a matter that must depend on such factors as local needs, the site available and its accessibility, and the proposed construction of the hospital.

For example, the transit of personnel and material between departments, which is one of the causes of extra expenditure in a very large hospital, is minimised if the hospital is built on a vertical rather than on a horizontal plan; and the relative cheapness of construction and maintenance of a very small hospital often implies less efficient medical service, especially in the lack of special diagnostic departments. The wide variation of standards is illustrated by the statement attributed by Sir JAMES to the staff of a Bush nursing hospital of 30 beds, that not more than 4 per cent. of the patients require a pathologist. The primary need, however, in isolated districts is adequate clinical supervision and nursing care, and that is clearly available in the hospitals under the contributory scheme of the Victoria Bush Nursing Association. Sir JAMES BARRETT'S main theme, that in all countries institutional rather than domiciliary treatment is being demanded by an increasing section of the public and will have to be supplied, is not likely to be disputed, and his exposition of a hospital insurance system so well adapted to the needs of the country it serves will command attention.

THE CARE OF THE MENTALLY DEFECTIVE

PUBLIC interest is easier to arouse in curable disease than in disorders which are apparently not amenable to treatment, and this no doubt has been one reason why mental defect has been largely left to philanthropy. Another reason for its neglect is the stigma of its supposed relation to insanity. But more and more has mental deficiency been forced on public notice as a problem in sociology by the Brock report and by the suspicion that a considerable proportion of crime is committed by those suffering from mental defect. What has not kept pace with this realisation is the effort to solve the problem. It is only slowly being grasped that much less spectacular measures than eugenic sterilisation or the intelligence testing of offenders can be undertaken by authorities which have the encouragement of informed public opinion. An important section of the Board of Control's report for 1934, a summary of which is given on p. 685, contains some record both of the activities of philanthropic bodies and of the tardy appreciation by public bodies of what can be done.

Only half the estimated probable number of defectives are notified, and of these rather less than half are in institutions. Something of the discrepancy which exists may be gauged from the fact that of the small number of criminals during 1934 who were proved to be defective almost three-quarters had not attended a special school at all, a figure closely resembling the Wood Committee's estimate that 77 per cent. of feeble-minded children are educated in ordinary elementary schools. Such a result can only arise from the fact that the provision of special schools remains too small; numbers of children who swell the overcrowded elementary school classes are incapable of profiting by the teaching provided. These facts are appreciated by education committees. But local authorities have no legal responsibility for the defective child between the ages of 14 and 16, and although this is a state of affairs that cannot last much longer, the knowledge that such a gap exists has played into the hands of authorities which shirk the care of defectives. The medical practitioner meets many situations in which a knowledge of the social implications of mental defect is of value. He is not limited to the thankless task of seeing that the unfortunate child is properly notified. Many defectives can be placed under guardianship in suitable homes, where they have a chance of doing some kind of manual work for which they are fitted. In Scotland, where guardianship is more generally used, the removal of defectives from home—often, alas, the environment most unsuitable for them—has had a beneficial effect. There are many cottage homes in the country which would welcome a paying guest of this kind if the medical man were to suggest it. There is work to be done both for defective children and adults. Special schools offer an opportunity of teaching posts to those who are better suited for this specialised work than for more routine teaching. Medical practitioners are likely to know the kind of women who, making hard weather of ordinary teaching, might flourish teaching the educable defective. Day centres and clubs, now being opened in various places, afford scope for many who would fight shy of more obvious philanthropy. At these centres defectives who live at home, or are under guardianship, can attend and do simple but useful work. Women applying for such posts need not have had previous experience in schools, though interest in Froebel method or its equivalent is of value. The extent of all these opportunities is outlined in a pamphlet issued by the Central Association for Mental Welfare, 24, Buckingham Palace-road, London, S.W.1.

Medical influence in these matters need not be restricted to the private contact between doctor and patient. Medical officials of the public bodies can only work for reform if the elected representatives on these bodies are pressing for progress. Whether as a member of the public health committee or as a magistrate the medical man's opportunities of stimulating interest in the care of the mentally deficient are considerable. There is no obvious reason why England should lag behind Scotland in the guardianship of mental defect, or why freer use should not be made of the services offered by the Central Association or the Guardianship Society. There are bodies whose title suggests more exciting efforts, but few which are working so quietly along progressive lines.

PERSONALITY AND AGE

PERSONALITY is the product of a large number of dependent variables every one of which must be studied in relation to the independent variable, age. It is fortunate that, in this country at any rate, documentary evidence is available for determining age with scientific accuracy, fortunate

since in its absence there would be little if any proof of age which would be accepted as conclusive in medical jurisprudence. For age as represented by solar time may be a very different thing from age in the biological sense. A person may be 30 years of *age* but 60 years *old* when judged by physical, physiological, or psychological criteria; and the converse is equally true. The tendency to change with advancing age is worthy of investigation. How frequently we fail to appreciate the significance of tendencies is illustrated by the many attempts to elicit the secret of longevity from the behaviour of an individual centenarian. The statements of the celebrated Brighton twins may be recalled. One attributed his health and longevity to his being a non-smoker and a total abstainer; the other was equally confident that his condition resulted from his lifelong generous indulgence in both alcohol and tobacco. Such was the leit-motif of the presidential address given by Mr. LL. WYNN-JONES, Ph.D., to the psychological section of the British Association at Norwich. He is careful to point out the difficulty of distinguishing between the senile and the pathological. A person who is as mentally alert at 90 as he was at 50 would be abnormal, but certainly not pathological. If he showed the mental deterioration customary to age it should more properly be regarded as a senile than a pathological change. In the individual personality there may be both pathological and senile changes which cause a deterioration of function long before the total personality has attained its maximum development and physiological perfection. There are functions which improve with age at least to middle life, which is admittedly a question-begging qualification; others which deteriorate with age; and still others which are largely independent of age. Dr. WYNN-JONES refers to the plebiscite invited in Germany a few years ago to enumerate the subjective sensations of becoming old. Analyses of the reports showed that the average age was 49, but individual variations were very wide, indeed from 18 to 82. As might have been expected, some laid greater stress on bodily than on mental signs; others did precisely the opposite.

In his "Adult Learning" (1928) E. L. THORNDIKE published a study of the changes in the ability to learn from age 15 to age 45. He concluded that nobody under 45 should restrain himself from trying to learn anything because of a belief that he is too old to learn. "If he fails in learning it, inability directly due to age will very rarely if ever be the reason." The reason is more commonly a constitutional inferiority to learn that particular thing or the lack of a sufficiently strong desire to encourage adequate application. THORNDIKE'S conclusions are naturally important in respect to schemes for adult education. On the average, visual acuity, which is probably the first physiological function to deteriorate with age, becomes at 50 sufficiently serious to handicap the individual in occupations where visual requirements are exacting. But in a test of reaction speed the average man of 80 is only 50 per cent. slower than the average man in his prime, and even the latter is less speedy than some men of 80. Industrial accidents decrease with increasing age from the greater experience and caution of the older workers. As a contrast, pedestrian accidents are far greater over 65. This of course is only to be expected when one considers the disadvantageous circumstances which come into play—increase in weight, decrease in agility and speed, impairment of sensory acuity, and a variety of senile effects on mentality. W. R. MILES has pointed out[1] that intellectual abilities, as measured by tests of memory and of intelligence, show a relatively small deterioration: and since differences between individuals at the older ages are often quite marked, other factors are probably more weighty than age. Prof. CHARLOTTE BÜHLER[2] singled out the importance of age in athleticism, utilising the records of 1930 as criteria of maximal motor abilities. It appeared that activities which demanded a maximum of expenditure of energy were best demonstrated by the youngest—e.g., the champion sprinter's age was 23·5 years. When greater economy of effort and demands of technique came into coöperation, the age of the champions became progressively older—e.g., the distance runner, 25·6 years; the tennis player 28·5 years; the polo player up to 50.

Dr. WYNN-JONES, in referring to Prof. BÜHLER'S conclusions, has extended the analysis to two typical British sports, cricket and golf. He observes that when the highest standard is demanded—batsmen who have exceeded three thousand runs in a season—the median age is 34·5 years, and that in golf the 37 open champions since 1894 showed a median age of 31 years, the extremes being 23 and 44. Dr. ADOLPHE ABRAHAMS has published some observations which bear upon this aspect of age in athletics. The tendency, he believes, is to accept too readily as inevitable a reduction of activity through increasing age. He has supplied examples of athletic improvement long past the time when it is generally looked for, and he attributes such improvement to increasing experience: not merely the acquisition of technique or of judgment in employing the physical resources to the best advantage, but a sort of individual cell education automatically acquired as the result of continued training and automatically utilised. Dr. WYNN-JONES concludes with the reminder that not only during childhood and adolescence, but throughout the life span, age as one of the primordial potencies should be studied more systematically. The relative importance of the various traits at different stages of life has a bearing upon such vital problems as the school-leaving age, the age allowance for scholarship candidates for the universities, and the necessity to ascertain in industry how far the handicaps of the older workers are due to their own physiological, mental, or vocational disabilities and how far to the age prejudice of employers.

[1] Stanford Later Maturity Publications, 1931, 2, 3.
[2] Der Menschliche Lebenslauf als Psychologisches Problem, 1933.

ANNOTATIONS

PLEURAL AND PULMONARY SEPSIS

In his Lettsomian lectures to the Medical Society of London, which have now been published in the transactions, Mr. J. E. H. Roberts covers the whole field of the surgery of pleural and pulmonary infections. The general reader will perhaps be most interested in the sections which deal with the septic infections of the lungs and pleura—bronchiectasis, pulmonary abscess, and empyema—for these are emergencies of medical practice which concern the general practitioner at least as closely as they do the workers in special departments. The adequate treatment of bronchiectasis, as Mr. Roberts rightly insists, demands the collaboration of physician and surgeon. The patient depends upon the former for diagnosis at a stage when surgery can still offer a hope of cure. It is no longer necessary to wait until gushes of stinking sputum at stated hours, clubbed fingers, and physical signs of expectoration bring melancholy proof of incurable disease. The injection of lipiodol as a preliminary to X ray examination of the bronchial tree is seldom necessary in such cases and may indeed be undesirable. But in the exploration of lungs damaged by pneumonia, in the investigation of obscure cases of chronic cough or hæmoptysis, lipiodol will often clarify the clinical picture and point the way to relief. In the same field diagnostic bronchoscopy has made notable advances. Early diagnosis in this disease as in most diseases implies the possibility of cure. Here lobectomy has achieved its most notable triumphs. The experience of Mr. Roberts enables him to support the teaching that this hazardous operation is less dangerous in early life than it is at a later age. As youthful sufferers from infected bronchiectasis, one of the most loathsome of all diseases, have hitherto been condemned to early death, it seems likely that this operation will be more frequently undertaken. The operative mortality, estimated at under 10 per cent., is a slight risk compared with that of the untreated disease. For the relief of patients whom surgery cannot help the system of postural drainage, advocated by Mr. H. P. Nelson, based upon the anatomy of the bronchial tree will be found far more efficient than the traditional bedside tipping and the creosote chamber, which was at best a clumsy and relatively ineffective method of inducing cough and expectoration.

In the treatment of empyema a tendency to postpone or to endeavour to avoid operation has been noticed since the discovery of the heavy death-rate among influenza patients suffering from watery empyemata and submitted to early operation. The finding of pus in the pleural cavity is no longer regarded as an indication for an emergency operation. Patients are now sometimes left soaking in their own pus for days until a series of test-tubes indicate that safety has at last been attained and the pleura may be opened without the risk of mediastinal flutter or other imagined evils. But whether pus in the pleura is of syn-pneumonic or meta-pneumonic origin, whether we have to deal with an empyema involving the whole pleural space or a pleural abscess limited by adhesions, the principles of treatment remain the same. It is only their application that must be altered. Pus must be removed and the sooner it is removed the better; the cavity must be obliterated, and any delay in its closure may result in a chronic empyema; the function of the underlying lung must be restored, and the earlier it is restored the more complete will be its restitution. Repeated aspirations are seldom curative and they are disturbing to the patient; they diminish but do not abolish toxæmia. Mr. Roberts advocates a single aspiration as a preliminary measure when the mediastinum is mobile, but for subsequent drainage he recommends an intercostal catheter and closed drainage system. There is general agreement that a closed drainage system, preferably with some form of suction, should be used whenever an empyema in the acute or early chronic stage is treated by thoracotomy and rib resection. The considerable number of cases of chronic empyema still encountered proves that the early treatment of empyema is often imperfect. Yet the principles upon which treatment should be founded are easy to understand, the technique of their application is simple, and the results of such treatment entirely satisfactory. It is neither to the credit of medicine nor surgery that two thousand years after the death of Hippocrates the treatment of empyema should so often be undertaken in ignorance and conducted in a perfunctory manner for which the patient has to pay, often in years of suffering and not seldom in permanent invalidity.

ACCIDENTS AND THE MORTALITY OF YOUNG ADULTS

A curious feature has been observed in German and French life tables which is absent from the corresponding English tables: the probability of dying in early adult male life (between ages 20 and 30) does not rise steadily with age but for a few years of life shows a slight decline. For instance, in Germany, in 1924–26, the mortality figure at age 22 was 457 per 100,000, while at age 29 it was only 404; the corresponding figures for England and Wales, in 1920–22, were 374 and 418. In the English figures there is an unbroken rise with advancing age, in the German ones a temporary improvement in the mortality experience, an improvement which is also absent in Germany and France from the female experience. This improvement amongst the males was attributed by Otto von Schjerning, in his book, "Sanitätsstatistische Betrachtungen über Volk und Heer" (1910), to the favourable influence of compulsory military service, an advantage which young adult Englishmen do not enjoy. The validity of this explanation is somewhat shaken by the results of an excellent statistical study published by W. J. Martin in the current number of the *Journal of Hygiene*. In life tables constructed on the census population of England and Wales in 1931 and the deaths registered in 1930–32, he finds that a similar course of mortality has now appeared in this country. As conscription cannot be invoked as an explanation he turns to the different causes of death in search of the responsible factor. The only two found to exhibit a decline in the mortality-rates between the ages of 24 and 27 are tuberculosis and accidents. The greater decline with age is shown by accidents, which have become proportionately much more important as a cause of death between 1920 and 1932; tuberculosis, on the other hand, has become proportionately less important. The new indentation in the English mortality curve for males is clearly derived from accidents, and excluding them the mortality curves rises steadily with age. The mortality of females from accidents follows much the same course, but with them such causes of death form in young adult life only about 5 per cent. of

the deaths from all causes, whereas for males they accounted in 1930–32 for 20 per cent. of the total mortality at ages 19–23. With females, therefore, the contribution of accidents is not sufficient to change the general trend of mortality with age; with males it is amply sufficient. Subdivision of accidents into type shows that the mortality from every type except road transport is, at ages 20–25, at a lower level in 1930–32 than in 1920–22. Road accidents have increased at these ages by 450 per cent. in ten years, and accounted for more deaths in 1930–32 than did all forms of accidents in 1920–22.

THE RADIUM BEAM

On another page Mr. Stanford Cade and Mr. F. M. Allchin describe the combined treatment of hypopharyngeal cancer with X rays and radium, suggesting that such combined treatment of extrinsic laryngeal cancer by irradiation with different wave-lengths may increase the radio-sensitivity of the tumour and so lead to retrogression of the disease. This treatment they claim is safe as compared with more intensive methods. The quantity of radium used was two grammes at a distance of 6–7 cm. from the skin, each patient receiving two treatments of 50 minutes each in the twenty-four hours, five days a week for six or seven weeks. The authors think that two grammes of radium may not be the best possible quantity for this purpose and state their intention of increasing the quantity as opportunity arises. It is announced that a new "bomb" containing four grammes of radium is to be assembled and tested in the workshop of the Westminster Hospital radium annexe at Hampstead. In this bomb the hollow globe will probably consist of a new tungsten alloy one and a half times the density of lead, with a gold or platinum collar at the outlet, by means of which the gamma rays will be more effectively prevented from spreading, the size of the bomb remaining unchanged. With the new apparatus radium beam treatment will be applied at a greater skin distance with the result that a more effective dose can be given at a greater depth below the surface. Minor improvements in the suspension of the bomb will avoid the necessity of adjusting the distance of the radium from the patient by raising or lowering the radium container. The present two-gramme bomb is at present continuously in use at the annexe for five days a week with three shifts of operators, two days of the week-end being reserved for experimental work. It will be a satisfaction to all concerned when the new building in Horseferry-road, with its ample allotment of space for radium and cancer work, will bring this work again into close relation with the clinical activities of Westminster Hospital.

TOXIC ACTION OF VOLATILE SOLVENTS

In recent years the industrial use of volatile solvents has increased, especially in the processes involved in cellulose spraying, in the rubber and artificial silk industries, and in the dry cleaning of clothes. It has long been known that inhalation of the vapour of many of these may have serious toxic effects. Thus chronic benzol poisoning is characterised by progressive anæmia with leucopenia and hæmorrhages; many of the chlorinated hydrocarbons of the aliphatic series produce severe and often fatal hepatic and renal damage. Inhaled in high concentration these vapours produce general anæsthesia, often with convulsions and other toxic effects on the higher centres. Dr. L. Dautrebande[1] has directed his attention to a different type of action, namely, that on the blood-vessels, the solvents investigated being benzol, petroleum ether (the lower boiling fractions present in petrol), and amyl acetate. After one minute's inhalation by dogs of air loaded with either benzol or petroleum ether there is not only a fall in blood pressure, but the occlusion of the carotid sinuses which normally gives a large rise in pressure is now without effect. Amyl acetate has no such action at ordinary temperatures, but if the inspired air is warmed to above 28° C. the same phenomena are observed. The normal response to carotid sinus occlusion returns about two minutes after withdrawal of the vapour. By studying the effect of inhalation of these substances before and after the administration of a number of drugs acting on different points of the vasomotor system, it is concluded that their action is due to a direct effect on the walls of the blood-vessels. This view is confirmed by the fact that all three solvents have a direct paralysing effect on isolated smooth muscle. Thus it is shown that saturated solutions inhibit the contractions of the frog's heart, the rabbit's intestine, the pig's ureter, and the virgin rabbit's uterus. Evidence is also adduced to show that benzol and petroleum ether when inhaled have a direct toxic effect on the heart; in fact, if benzol and adrenaline are administered simultaneously, death often results from ventricular fibrillation, benzol in this respect resembling chloroform. Dautrebande considers his results of significance for industrial toxicology, and it will certainly be of interest to see if similar phenomena can be detected in man now that attention has been drawn to them. The vasomotor paralysis may well explain the syncope which occurs in acute poisoning with these substances. It is unlikely, however, that these effects are related in any way to the serious damage to the hæmopoietic system which occurs in chronic benzol and petroleum poisoning.

[1] Presse méd., July 6th, 1935, p. 1081.

PRACTICAL LESSONS FROM IRRADIATION OF BODO CAUDATUS

The effect of gamma ray irradiation upon the growth of the protozoon *Bodo caudatus* has been the subject of prolonged and careful study over a considerable period by Miss Muriel Robertson, D.Sc., and her collaborators at the Lister Institute, and in two recent publications the results obtained have been summarised.[1 2] It is the non-necrotic effects of gamma rays in restraining growth that have been studied. The organisms were not killed by the amount of radium used; their food-supply was unaffected by the irradiation and the reactions in regard to rates of growth of the successive generations of cells, their size and physiological reactions could be studied in comparison with those of controls under normal conditions.

It was found that the cells of less than a certain age at the moment of exposure were greatly delayed in entering into division, so that the increase in numbers could be restrained till it equalled only 20 to 30 per cent. of the normal growth. This extreme restraint of the multiplication was an expression of the reaction of sensitive cells exposed for the first time in their cycle of growth from their emergence at division of the parent to their maturity or moment of ripeness for division. Upon further prolongation of the irradiation the growing cultures showed a recovery in rate of multiplication and the subsequent

[1] Lawrie, N. R., and Robertson, M.: Biochem. Jour., 1935, xxix., 1017.
[2] Robertson, M.: Brit. Jour. Radiol., 1935, viii., 502 and 570.

passage through this cycle (that is the production of the second and later generations) in the presence of the radium occupied a lesser time than the first. Expressed in hours, it was shown that irradiations of two hours and less were of little effect, exposures of 4 to 8 hours produced the greatest actual check in the multiplication, while those lasting for periods of from 10 to 22 hours which last was the limit of the experiments, showed growth varying only within narrow limits and averaging about 60 per cent. of the normal computed over the whole period. There was no further summation of effect with the increasing duration of the exposure after the tenth hour, which coincided with the evolution of the second generation produced during the irradiation. The evolution of the cultures in the presence of the radium was characterised by an enhanced size in the irradiated cells in comparison with the normal. The physiological reaction to the radium which was correlated with this larger size has been studied by Lawrie and Robertson.[1] They found that the very short irradiations of 2 to 3 hours were marked by a reduction in the nitrogen metabolism of the irradiated cells as judged by the production of ammonia; after about 3 to 4 hours on the radium plaque the ratio between the normal and irradiated in this respect lay either slightly below or approached unity. From 5 hours' however to somewhere about 9 hours' exposure the nitrogen metabolism as expressed per bodo was definitely greater, actually increasing to about double that of the normal; the ratio finally settling for irradiations of longer duration (10 to 22 hours) at about 42 per cent. above the normal. Upon removal from the radium, an effectively irradiated culture of *Bodo caudatus* after a period of time begins to accelerate in the rate of multiplication above the normal until if sufficient time is allowed the numbers of cells on the released plate comes to equal those in the normal control. During this compensatory process the enhanced size produced by growth in the presence of radium returned to the normal. There was no radium fastness and re-irradiations were always effective in some degree. The cells having approached the normal again had to be reconditioned if they were exposed again and went through the check in rate and rise in size as in a first exposure. In so far as they had not returned to the normal during the released period the power to evince the rise in rate of increase which was now imminent was held in check by the re-exposure, the multiplication was kept at the uncompensated level, or was further depressed.

These results may well have a practical application in therapeutic irradiation, but from the medical standpoint they are minimal effects, since no necrosis was induced and there was no change in the value of the ample food-supply. The occurrence of a particularly sensitive period in the life of the growing cell seems once again to have been demonstrated, and the importance of considering the growth of cells in relation to the succession of generations emerges clearly. Thus a single effective irradiation appears to be one that lasts over rather more than one normal generation time of the growing cells. Exposures of less than 2/5 of the generation time were practically speaking ineffective. The cells of the second generation produced during a continuous exposure show definite recovery in the rate of multiplication in these non-necrotic irradiations, but they are forced into a larger size and show a higher nitrogen metabolism. Under the conditions of the practical irradiation of tumours the cells might, without necrotic changes actually being produced, be rendered unable to respond to the exacting physiological demands of growth in the presence of radium. It must also be added that tissue cells, being more sensitive than protozoa, are liable also to irreversible injuries which do not come into consideration in these studies. The absence of further summation of effect with increase in the duration of the exposure beyond that achieved at the end of the second generation of cells in continuous irradiation is a point of practical importance. Taken in conjunction with the interesting fact that after a fully effective irradiation it requires the period of one to one and a half generations of growth after the removal of the radium before the compensatory acceleration of growth sets in in these uninjured organisms, it shows that long intermissions in exposure may be inserted without loss of total effect. This was tested experimentally and the effect of properly spaced interrupted irradiations was found to lie within the limits of continuous irradiations over the whole experimental period of four to four and a half generations (22 hours). As further points of practical interest it may be noted that there is no evidence of any primary stimulation of growth in these non-necrotic irradiations. There is also no sign of radium fastness in the sense of acquired resistance or insensitiveness due to previous exposure. The organisms which showed temporary adaptation to radium by the recovery of their rate of multiplication in the second and subsequent generations of growth in a continuous exposure returned to normal upon the elapse of from 1·7 to 3 generations of growth in the absence of radium, and were then exactly as sensitive as on the first occasion. The adaptation was a purely physiological one made appreciable by the enhanced size and raised metabolism which seemed to be the necessary condition of growth in the presence of gamma irradiation. It is again noticeable here that the cultures were more sensitive to the effects of irradiation in periods of rapid growth and oxygen uptake than in periods of lesser activity in these respects.

A FRENCH SANATORIUM VILLAGE

AT the end of the war France was faced with a serious deficiency in sanatorium accommodation for middle-class patients. A depreciated currency made treatment in Switzerland possible only for the wealthy and the French Alps did not at that time provide an adequate substitute. To meet this deficiency the "Association philanthropique des villages-sanatoriums de haute altitude" was formed and a suitable site for development was selected at Passy, a sunny sheltered plateau about 4000 feet above sea-level and not many miles distant from the Mont Blanc range. Eight sanatoriums have now been built in this neighbourhood containing in all 1200 beds. A thoracic surgeon from Paris pays regular visits so that operations when required can be carried out without breaking the continuity of sanatorium treatment which is so well organised by Dr. F. Tobé. The bulletin [1] recently produced by the group of Passy doctors, intended as the first of a series, describes the health resort and its amenities, with a number of short clinical papers illustrating problems of treatment. Among these is a paper by Dr. J. Rolland and Dr. A. Maurer on pulmonary complications consecutive to thoracoplasty. Thirty-six post-operative complications occurred in 169 cases and sixteen of these ended fatally. Basal congestion was found to be more frequent after phrenic evulsion, and

[1] Bulletin et mémoires de la société médicale de Passy (Haute Savoie), No. 1, December, 1932–December, 1934.

the authors deprecate routine paralysis of the diaphragm on the affected side. As might be expected, complications were relatively few among patients who had lost their fever and toxæmia during a preliminary period of sanatorium treatment. Those with a large amount of sputum, and in particular those showing a fluid level in a cavity, were especially prone to post-operative pulmonary complications. Full use is being made at Passy of the exceptional facilities for the clinical study of tuberculosis, and further bulletins will be awaited with interest.

REBUILDING PROGRAMME

THOUGH local conditions provide the text for the argument in a stimulating study[1] of the housing question in Manchester Sir Ernest Simon is better qualified than most people to write on housing problems in general, and much of what he says deserves a wider application. Beginning with a glance at the terrible story of laissez-faire in the housing of the lower paid workers, he and his collaborator set out the achievements of the city council in reconditioning, in building new houses, and in town-planning. One of the most important parts of the book is the section, to which Lady Simon contributes, on Wythenshawe, the first complete garden city planned as a satellite by a local authority. All the difficulties, parliamentary as well as local, which have delayed the development of Wythenshawe are described in detail and quite impartially. The conclusion stands out that a big local authority is very well placed to foster the garden city movement, because it can supply both cheap capital for development and houses in large numbers to make the capital remunerative. The absence of these two factors has done much to retard the successful growth of Welwyn and Letchworth. It is perhaps going rather far to say that the garden city movement can only succeed if it is sponsored by our great cities, but it is highly probable in view of the success of the Wythenshawe experiment that this is the line which garden city development will generally follow. The story of Wythenshawe illustrates two conditions which are vital to success in an enterprise of this kind: (1) the mother city must own the land, and (2) it must also be the local authority for the satellite. To state these two conditions is to indicate some of the difficulties to be overcome, but it is to be hoped that even now many progressive local authorities are laying plans to follow the example of Manchester.

In discussing the future Simon and Inman emphasise the need for a long range plan, and give reasons for the view that factors of population, transport, and trade are likely to be more stable and therefore more amenable to plan during the coming than during the past 100 years. The relative merits and costs of cottages and flats are compared, the former being favoured. In conclusion, a time plan is suggested, stretching over a century, of which 50 years are allotted to the building of 20,000 additional houses and to the replacement of the whole of the existing slums in Manchester, and 50 years thereafter to the rebuilding of the business centre. The cost of the first 50 years' programme, including a second satellite garden city, is estimated at £50,000,000, apart from Government subsidies, and in this connexion it is noteworthy that during the fourteen years, ending 1934, the expenditure of the housing department has been on an average £1,000,000 a year, precisely the figure estimated for the future.

The problems of replanning a built-up area are different from and more complex than those of creating a new garden city on an agricultural site. Here also if the slums are to be rebuilt the city council must do it. An incidental result will be the transfer to the municipality of the freehold of most of its area. It is significant of the change of public opinion on housing that these far-reaching proposals should be made.

[1] The Rebuilding of Manchester. By Sir E. D. Simon, M.A., chairman of the Manchester Housing Committee, 1912–23, and J. Inman, B.A. London: Longmans Green and Co., Ltd. 1935. Pp. 173. 5s.

TREATMENT OF SYPHILIS DURING PREGNANCY

CONGENITAL syphilis may be an irreparable tragedy for the victim, and the fact that syphilis in the new-born living child is readily amenable to early treatment is no excuse for allowing women to go through a full-term pregnancy after several miscarriages, only to be faced ultimately with a florid syphilitic offspring. In an admirable survey of 2150 pregnancies in coloured women whose Wassermann reaction was positive, carried out over a period of 17 years, J. R. McCord,[1] of Atlanta, Georgia, shows that timely treatment of the mother assures her of a syphilis-free baby in 95 per cent. of cases. What he rightly calls "disastrous pregnancies" can in fact be reduced from 49·4 per cent. in the untreated to 5·4 per cent. in the treated by insistence on a routine Wassermann reaction early in pregnancy, followed by a combined arsenical and mercurial course. Dr. McCord bases his treatment entirely on the prevention of disease in the baby. "We make no effort," he says, "to cure the disease in the mother." But while those in this country who have had similar opportunities will agree with him that it is desirable for pregnant women to have a Wassermann reaction done at least once during pregnancy, preferably early enough to ensure six months' treatment before the birth of the child, they will not agree with McCord's principle that antepartum therapy should be based only on the prevention of the disease in the child, not on its eradication in the mother. His criterion of sufficient treatment designed to this end is 10 injections or more once a week of 0·45 gramme N.A.B. combined with a heavy metal (mercury or bismuth), and he recommends the continuance of the treatment irrespective of its effects on the mother's Wassermann reaction. There is in fact little danger in submitting pregnant women to rigorous antisyphilitic treatment extending over more than twice the period suggested. By this means it would be possible almost to guarantee the birth of a healthy child as far as freedom from syphilis is concerned, and the mother would herself be receiving curative rather than merely palliative treatment.

[1] Jour. Amer. Med. Assoc., 1935, cv., 89.

AN ANGLO-SCANDINAVIAN PILGRIMAGE.—The Viking Society, of which Mr. A. Rugg-Gunn, F.R.C.S., is president for the third successive year, is organising a celebration at Shaftesbury on Oct. 5th in honour of the ninth centenary of Canute the Great. The meeting will be attended by several Scandinavian ambassadors or their representatives, and, it is expected, by the Earl of Shaftesbury, Lord Lieutenant of Dorset. The programme includes an Anglo-Scandinavian religious service in the Abbey ruins, a reception by the Mayor, luncheon, lecture, ramble around the historic city, and tea. The inclusive cost of the pilgrimage is one guinea per head, and any medical man or woman is welcome to join it. Application for tickets should be made to Mr. A. W. Johnston, 30, Goblin's Green, Welwyn Garden City.

PROGNOSIS

A Series of Signed Articles contributed by invitation

LXIX.—PROGNOSIS IN JEJUNAL ULCER

JEJUNAL ulcer is used as a comprehensive term to include ulceration occurring in the jejunum, around the margin of the stoma and in the duodenum following gastro-duodenostomy. The prognosis is much the same in all although it has been stated that the purely jejunal ulcer has a slightly greater tendency to perforation while the marginal ulcer is more prone to develop adhesions with secondary involvement of the transverse colon.

A review of the literature does not reveal any reference to the prognosis but results of treatment are given on the medical side by A. F. Hurst and M. J. Stewart (THE LANCET, 1928, ii., 742), and on the surgical side by A. J. Walton (Brit. Jour. Surg., 1934, xxii., 33) and Garnett Wright (Ibid., 1934, xxii., 433). Hurst claims that quite a large proportion of cases can be cured by medical means provided the patient adheres closely to a prescribed régime. His figures are set out in Table I.

TABLE I.—(*Hurst*)

Cases in New Lodge series	35
,, treated medically	25
,, with satisfactory result	13

Walton and Garnett Wright on the other hand regard the results of medical treatment as most unsatisfactory, practically all cases coming to operation sooner or later. They agree that these cases offer some of the biggest and most difficult problems in the realms of surgery and that the results are by no means brilliant. For brevity I have reproduced Garnett Wright's final table of results in Table II., and given A. J. Walton's results in Table III.

TABLE II.—*Results of Operative Treatment* (*Garnett Wright*, 456 *cases*)

Good	150	Later results unknown	130
Fair	29	Died as result of { operation	91
Symptoms still present	44	{ disease ..	12

TABLE III.—*Immediate Results of Operative Treatment* (*Walton*, 79 *cases*)

Cases	79
Operation of partial gastrectomy	61
Deaths	16

In a personal communication Sir James Walton tells me that the later results of partial gastrectomy in his series have not yet been published, so that from his figures one is unable to assess the true value of this particular operation. Tables II. and III. show a high operative mortality, although it must be pointed out that in the last 20 of Walton's series only one death occurred. After deducting the untraced cases, Table II. shows a percentage of 51·8 per cent. as cured, while Table III. gives 57 per cent. as the proportion of partial gastrectomies successful as far as immediate results are concerned. Neither Walton nor Garnett Wright is in favour of small local operations because of the extreme liability to recurrence of ulceration; both recommend the bigger operation, namely, partial gastrectomy, provided the patient's general health is thought good enough to stand the strain.

RUTHIN CASTLE CASES

For the purpose of this paper I have collected and followed up 30 cases of jejunal ulcer admitted to Ruthin Castle. All have been traced up to the present time. The mode of treatment, whether medical or surgical, was decided after full consideration of the clinical and radiological data in each case. Cases showing an uncomplicated ulcer without marked mechanical defects of the stoma or loops (as shown by X rays) were treated by medical measures in the first instance, but if the immediate response was poor or the patient relapsed soon after a complete and thorough course, operation was advised. Of the 30 cases, 14 were treated by medical means alone; a further 8 relapsed after medical treatment and were operated upon. The results in these two groups are shown in Tables IV. and V.

TABLE IV.—*Results of Medical Treatment* (14 *cases*)

Cases cured	9
,, improved	1
Still complaining of symptoms	2
Dead	2

The 9 cases labelled "cured" have remained well for periods ranging from 4 to 10 years. The two deaths were due to sudden large hæmorrhages. In one this occurred twelve months after treatment and the patient had complained of no symptoms whatsoever. In the other intermittent mild indigestion had continued in spite of careful after-care.

TABLE V.—*Operation and Result after Medical Treatment had Failed*

Case.	Operation.	Result.
1.	Gastro-duodenostomy	Good.
2.	,, ,, ...	Patient dead.
3.	,, ,, ...	Poor.
4.	Local operation and then partial gastrectomy	Good.
5.	Do. do. ..	Patient Dead.
6.	Two local operations	Good.
7.	,, ,, ,, ...	Good.
8.	,, ,, ,, ...	Poor.

In this group five cases had to be operated on twice, showing the poor and uncertain results of local operations, which tends to confirm what Walton and Garnett Wright had found in their series.

The remaining 8 out of the 30 were immediately subjected to operation, the clinical and radiological findings being such that medical treatment was contra-indicated. These findings were: (1) gastrocolic fistula; (2) obstruction due to inflammatory thickening around the ulcer; (3) probable involvement of the transverse colon as shown by lower abdominal pain and distension or by radiological signs of adhesions to,. and irritation of, the large bowel close to the site of the ulcer; (4) repeated serious hæmorrhage; (5) failure to respond to medical treatment before admission; (6) marked mechanical deformities of stoma or loops as shown by radiological examination.

In this group there were 3 cases of gastrocolic fistula and all died immediately after operation; 2 cases ultimately had 4 operations each, both being finally subjected to partial gastrectomy; one did well and the other died as a result of the operation. Of the remaining 3 cases, one has had two local operations and is now fairly well; the second has had three local operations and is now doing well, while the third had an immediate partial gastrectomy and has remained well for four years.

To sum up—17 cases, that is, rather more than half, have done well and there were 9 deaths in the series. The results of medical treatment compare

quite favourably with those of surgery, although it must be remembered that only the unresponsive and complicated cases were submitted to operation. It is clear that chosen cases of jejunal ulcer can be cured by medical means, and this is in agreement with the findings published by Hurst. Also the analysis of our cases goes to confirm Walton's and Wright's contention that local operations prove unsatisfactory and that partial gastrectomy offers the best cure if surgical interference is inevitable, even though the mortality of this operation is high.

The study of this series has brought out certain other factors which may have a bearing on the prognosis. The average age on admission was 46; 9 patients were 40 years old or under, and of these 2 had four operations each and 6 had two operations each; while of the 9 patients who did well medically, 7 were over 55 and there was only 1 under 40. If any conclusion as to the effect of age on prognosis can fairly be drawn from so small a series, it is that jejunal ulcer is more serious and harder to cure in patients under 40 years of age, while those over 55 tend to do well with medical treatment provided there are no complications.

The fractional test-meal findings are also interesting. This test was done on 21 out of the 30 cases. Superacidity was present in 15; normal acidity in 2 and subacidity in 4. Of those with superacidity 8 were treated medically and 7 did well; 7 were treated surgically and 4 did well. Thus superacidity is frequently found in this disease, but this in itself does not seem to affect the ultimate prognosis. However, it confirms the common-sense view that careful dieting and alkalis should be continued indefinitely, bringing this aspect of the disease into line with the accepted principles of treatment in duodenal ulcer. The importance of this after-care has been emphasised repeatedly by the doctors who have written about the patients' present condition, it being frequently stated that the maintenance of a good régime usually means health, while the reverse leads to recurrence of symptoms and chronic ill-health.

Finally temperament, economic position, and mode of living have more than a little influence. The phlegmatic individual whose circumstances of life are such as to be able to avoid much worry is more likely to do well. It is instructive to note that 5 out of the 30 cases occurred in doctors who are prone to irregular hours, hurried meals, scanty holidays, and often an anxious existence.

Complications.—In our series the most dangerous complications were: (1) gastrocolic fistula, 3 patients, all of whom died; (2) perforation into abdominal cavity, 3 patients, 1 died and 2 still have disabling symptoms; (3) repeated severe hæmorrhage, 10 patients, 4 of whom died; (4) obstruction with cyclical vomiting, 2 patients; (5) persistent pain which led to morphia addiction, 3 patients.

CONCLUSIONS

(1) Jejunal ulcer must be regarded as a grave complication of gastroenterostomy.

(2) Patients must be considered individually as to whether the primary treatment should be medical or surgical, and medical treatment should be given a trial in all uncomplicated cases.

(3) Of surgical procedures partial gastrectomy seems to be the most useful.

(4) In all cases after-care plays an important part.

(5) The most serious complications are gastrocolic fistula, perforation, and repeated hæmorrhages.

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Physician, Ruthin Castle, North Wales.

THE SERVICES

ROYAL NAVAL MEDICAL SERVICE

Surg. Comdrs. A. Craig to *Victory* for Haslar Hospital, and J. H. B. Crosbie to *Victory* for R.M. Infirmary, Portsmouth.

Surg. Lt.-Comdrs. E. C. Davis, A. L. McDonnell, and S. G. Weldon to be Surg. Comdrs.

Surg. Lt.-Comdrs. E. H. Rampling, J. G. Holmes, E. R. Sorley, W. P. E. McIntyre, E. T. S. Rudd, E. E. Malone, T. F. Crean, J. M. Sloane, and C. B. Fox to *President* for course.

J. Carlton, J. M. Fitzpatrick, A. E. Ginn, G. S. Grist, N. S. Hepburn, F. G. Lamb, J. Lees, D. Shute, H. G. Silvester, D. Simpson, J. L. S. Steele-Perkins, and W. F. Viret entered as Surg. Lts. for short service and appointed to *Victory* for R.N. Hospital, Haslar, for course of instruction.

Act. Surg. Lts. (D) to be Surg. Lts. (D): F. L. Ferris, A. C. Horne, and K. E. J. Fletcher.

ROYAL AUSTRALIAN NAVY

Surg. Lt.-Comdr. J. M. Flattery promoted to Surg.-Comdr.

ROYAL NAVAL VOLUNTEER RESERVE

Surg. Lt.-Comdr. H. Winstanley to *Effingham*.

Surg. Lt. D. W. Bawtree to be Surg. Lt.-Comdr.

Proby. Surg. Lts. W. G. Gill and H. G. Rees to *Victory* for Haslar Hospital.

ROYAL ARMY MEDICAL CORPS

REGULAR ARMY RESERVE OF OFFICERS

Lt.-Col. G. W. G. Hughes, D.S.O., having attained the age limit of liability to recall, ceases to belong to the Res. of Off.

ARMY DENTAL CORPS

Lt. (on prob.) W. F. Finlayson is restd. to the estabt.

Lt. (on prob.) N. T. McNie is confirmed in his rank.

TERRITORIAL ARMY

Capt. T. A. S. Samuel, M.C., to be Maj.

Lt. R. J. C. Hamilton to be Capt.

ROYAL AIR FORCE

Flight Lts. L. S. Everett to R.A.F. Station, Ismailia, and J. Magner to No. 1 School of Technical Training (Apprentices), Halton.

Flying Offrs. P. A. Cooper to Central Flying School, Upavon; L. E. A. Dearberg and R. C. H. Tripp to Princess Mary's R.A.F. Hospital, Halton.

FELLOWSHIP OF MEDICINE AND POST-GRADUATE MEDICAL ASSOCIATION.—The following courses will take place on the undermentioned dates: chest diseases at the Brompton Hospital (Sept. 23rd to 28th, all day); dermatology at St. John's Hospital (Sept. 30th to Oct. 31st, afternoons); proctology at the Gordon Hospital (Sept. 30th to Oct. 5th); cardiology at the National Hospital for Diseases of the Heart (Oct. 7th to 18th, all day); medicine and surgery at the Metropolitan Hospital (Oct. 7th to 19th, all day); anatomy and physiology at the Infants Hospital (Oct. 7th to Nov. 29th, Monday, Wednesday, and Friday evenings). Special concentrated week-end courses will also be given as follows: ophthalmology at the Royal Westminster Ophthalmic Hospital (Sept. 28th and 29th); fevers at the Park Hospital (Oct. 5th and 6th); heart and lung diseases at the Royal Chest Hospital (Oct. 12th and 13th); obstetrics at the City of London Maternity Hospital (Oct. 19th and 20th). There will also be lectures on X ray interpretation at the Medical Society of London, Chandos-street (Sept. 30th to Oct. 4th at 5 P.M.); on endocrinology at the National Temperance Hospital (Tuesdays and Thursdays, Oct. 8th to 24th at 8.30 P.M.); gynæcology at the Medical Society of London (Thursdays, Oct. 10th to Nov. 7th at 4 P.M.). Detailed syllabuses can be obtained from the secretary of the Fellowship, 1, Wimpole-street, London, W. 1. Courses and lectures are open only to members and associates of the Fellowship.

SPECIAL ARTICLES

PLASTER TECHNIQUE IN THE MODERN TREATMENT OF FRACTURES

By K. H. Pridie, M.B. Lond., F.R.C.S. Eng.

SURGICAL REGISTRAR TO THE FRACTURE CLINIC AND ORTHOPÆDIC DEPARTMENT OF THE BRISTOL ROYAL INFIRMARY

The great advance in traumatic surgery during the last few years has resulted from the adoption of the principles and methods of Dr. Lorenz Böhler, director of the Hospital for Accidents in Vienna. In his book on the treatment of fractures, which is available in translation to English readers,* he emphasises the vital importance to the community of the organised treatment of fractures, which should no longer be left to junior house surgeons to treat. There is probably no branch of surgery where the difference between efficient and inefficient treatment is so marked; for instance, a man with a simple fracture of the leg, instead of being back at work in three months, may be crippled for life with an ununited fracture or a painful leg. The saving of compensation and of lost wages repays the cost of the clinics many times over.

It is the organisation of these special clinics that is so important; first, because it is not economic to apply the method to individual and isolated cases, and secondly, because a great factor in the success of the method is psychological. To see other patients with leg injuries similar to his own walking without pain after a few days has such a good effect on the new patient that he is no longer a mental invalid, and very rarely is the compensation neurotic encountered. Many cases of Pott's fracture and fracture of the tibia can walk home the same day as their injury, and need not stay in bed one day. Many of them are able to carry on their work and women patients are able to look after their housework. But no amount of physiotherapy, electrical treatment, or massage will restore full function to a patient whose fracture has been incompletely reduced. It is waste of time and money for a patient with an unreduced Colles's fracture to receive massage and physiotherapy, for the end-result will only bring discredit to the masseuse.

A childish superstition of reverence surrounds a padded piece of wood. Often a patient is sent up to hospital in a splint whose weight is causing painful displacement of the bone-ends, for example, a back-splint and foot-piece used for a below-knee fracture. In the case of a Pott's fracture, a firm bandage over wool gives far more support than a back-splint and foot-piece where the foot is anchored to the splint and the tibia is free to rotate and cause displacement and pain. Patients in these splints dread being touched, and frequently remove them when the doctor has gone. Böhler has introduced the unpadded cast as a method of fixation after reduction. Plaster-of-Paris is unequalled for the fixation of fractures, but the method of application has to be learnt, and unless the surgeon knows how to apply these casts the results will be poor. After the application of unpadded casts the patients feel comfortable, they sleep at night, and no longer dread being touched.

The removal of splints for massage is wrong; there is risk of displacement of the fractured bone-ends. The only massage the patients need is the massage of function. Massage should not be allowed till the bones are firmly united; then, if the reduction has been satisfactory, and the patient has been using the limb, there will be full range of movement two weeks after removal of the plaster.

It is so essential for the teaching of students to secure a plaster of standard weight, strength, and application, that a bandage of constant composition must be used. Hospital-made bandages vary in different institutions, and even in different wards of the same institution. For these reasons I have adapted my technique to the three-yard Cellona bandage.† Cost and comfort have been the main factors in the evolution of this technique. The cost of the entire treatment is greatly diminished for these reasons:

1. The surgeon's time is only spent on reduction and fixation of the fracture.
2. Using these methods the majority of fractures can be treated as out-patients, hospitalisation being avoided.
3. Patients' visits and travelling expenses are reduced to a minimum.
4. Physiotherapy (a costly form of treatment) is only required in about 5 per cent. of cases, as compared with 100 per cent. using the old methods. The patient by his activity performs his own physiotherapy.
5. The majority of patients are able to follow their own occupation, without consequent loss of wages, and in any case disabilities and invalidism are avoided. Women can perform their household duties without outside help, and children can continue to attend school.

Besides this it is possible with the technique to produce casts of a

* The Treatment of Fractures, by Dr. Lorenz Böhler. Fourth English edition. Translated from the German by E. W. Hey Groves, emeritus professor of surgery, University of Bristol. Bristol and London. 1935. (Reviewed in THE LANCET, 1935, i., 992.)

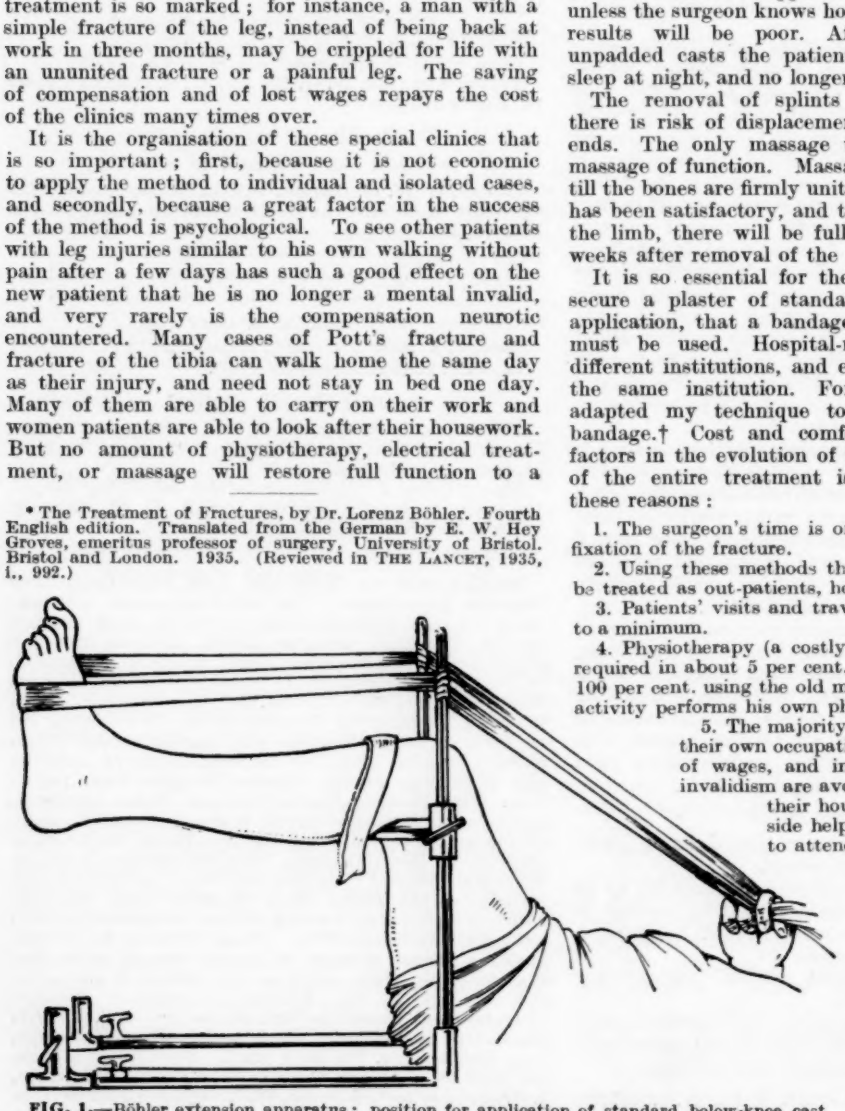

FIG. 1.—Böhler extension apparatus: position for application of standard below-knee cast, in cases not needing skeletal traction for reduction.

† The Cellona bandage, which is made by the manufacturers of Elastoplast (T. J. Smith and Nephew Ltd., Neptune-street, Hull), contains 90 per cent. by weight of plaster; the setting time may be regulated as desired; and although exceptionally strong, it is the lightest plaster bandage yet produced.

minimum weight, an advantage in ambulatory cases of lower-limb fractures.

First Principles

The three principles of fracture treatment are :

1. To reduce the displaced bone-ends as soon and as accurately as possible.
2. To maintain uninterrupted fixation of these bone-ends until union is firm enough to dispense with external splinting.
3. To use the affected limb as much as possible during the period of fixation.

The period of disability following any fracture is determined by the accuracy of reduction. The blood-vessels and lymphatics at the site of a fracture are often kinked or pressed on by displaced bone-fragments, causing œdema ; this indirectly leads to stiffness, muscle adhesions, and limited

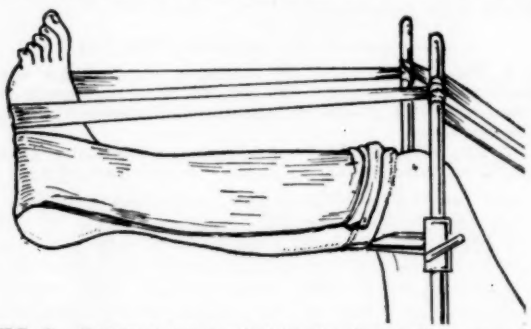

FIG. 2.—U-shaped slab applied to the limb ; the excess is turned back so that it does not project beyond the felt.

movement. Following a fracture, there may be three displacements :

1. *Shortening.*—This can be easily corrected if the reduction is performed during the first few hours following the accident, but, if muscle-adaptive shortening has taken place, this deformity is extremely difficult to overcome. There is no excuse for shortening to occur in a fracture case, unless there has been actual loss of bony substance.

2. *Lateral displacement.*—It is frequently not possible to replace the bones exactly into their previous anatomical position, but provided there is no angulation, this lateral displacement may cause no disability, although it may give rise to swelling and prolong the time of healing.

3. *Angulation.*—Perfect apposition of bone fragments is of no use if angulation is still present. Angulated bones tend to bend and frequently cause arthritis in the joints above and below the fracture, due to the mal-direction of weight-force.

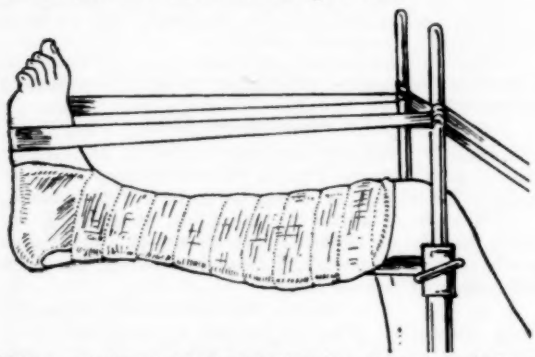

FIG. 3.—U-shaped slab fixed to limb by means of a wet gauze bandage.

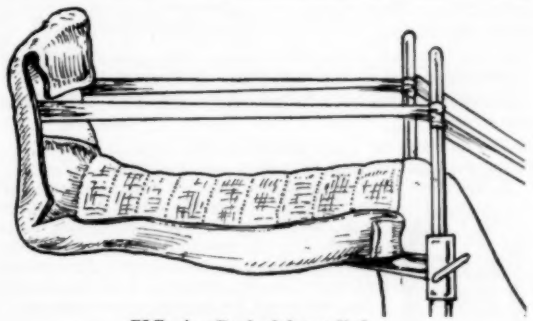

FIG. 4.—Back-slab applied.

If the function of the neighbouring joint is not to be severely handicapped, great care must be taken in the reduction of fractures of bones near joint surfaces, for example, fractures around the knee-joint, Pott's fractures, fractured surgical neck of humerus, supracondylar fractures, Colles's fractures, fractures of radius and ulna. The radius rotates around the ulna, and any marked angulation of the radius from its normal shape will block the movements of pronation and supination.

Stiffness of joints following an injury is chiefly due to muscle adhesions, and these do not form if the limbs are used during the whole period of disability. The following written instructions should be given to each patient at the first visit :

1. For the next 12 hours, when not actively moving the injured limb, it must be kept elevated and not allowed to hang down and thereby encourage swelling.
2. During the night time the injured part must be kept elevated above the rest of the body. For instance, the

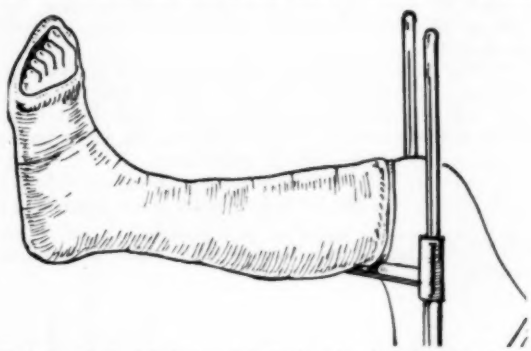

FIG. 5.—Back-slab fastened to limb, using two 4 in. by 3 yd. bandages. The finished cast extends 1 cm. beyond the toes.

forearm must be placed on a pillow across the chest and the leg raised on a pillow resting on a box.

3. During the day the fingers, in the case of a fractured arm, must be kept moving constantly. An injured leg is to be used as much as possible and the patient should be able to walk up to one mile within the first week, increasing to greater distances in subsequent weeks. No crutches should be used, only sticks, which should be soon discarded. No slings to be used, but the hand, when not in use, must be kept elevated by making the fingers grip the opposite coat lapel.

4. Should the plaster become tight the patient must immediately report to the doctor, so that the plaster may be split. (In every cast a portion equal to at least a quarter of the circumference of the limb is extremely thin, and can be cut with ease.)

Indications of too tight a cast are swelling, blueness, or numbness of the extremities, not relieved by elevating the limb, and inability to move the toes

or fingers. The patients must be seen daily until there is no further fear of swelling. If a limb is greatly swollen when first seen, it is not completely surrounded by a cast until the following day.

Possible causes of failure in using this technique are:

1. The fracture may not have been reduced. Plaster casts must not be put on unreduced fractures.

2. The cast may fit badly. Complete plasters must not be applied to arm fractures on the first day, but only after reduction has been verified by X ray and the swelling has diminished. If a limb is grossly swollen at the time the fracture is reduced, the swelling must be massaged with the limb elevated before the cast is made. If this precaution is not taken the cast will become loose when the swelling diminishes. If the swelling cannot be reduced in this manner, a temporary, non-completed cast must first be used, until the swelling has been reduced.

FIG. 6.—Böhler iron. Bristol pattern. (Medical Supply Association.)

3. Inadequate use of the injured part, leading to stiffness of joints.

Technique

1. The limb should be cleaned with ether soap. Strong antiseptics should not be used, as these kill the skin. Dead skin under plasters forms an excellent nidus for bacteria.

2. If the limb is obviously broken, and the fracture site is easily seen, the leg should be rendered painless by the administration of local anæsthesia into the hæmatoma between the fragments. The taking of true antero-posterior and lateral view radiograms is then no longer a painful procedure. Often the radiologist is unable to secure a true lateral view of a fracture because of the great pain entailed by moving the patient; local anæsthesia here relieves much suffering.

3. The limb should be reduced as soon as possible following the fracture. If the case is left, swelling and œdema will occur, and even skin blistering. If the reduction can be carried out within a few hours of the accident, no swelling will occur.

4. If the fracture for some reason cannot be reduced immediately, the following procedure is recommended:

(*a*) Any gross deformity can be corrected by hand. This relieves kinking of blood-vessels and tends to prevent swelling.

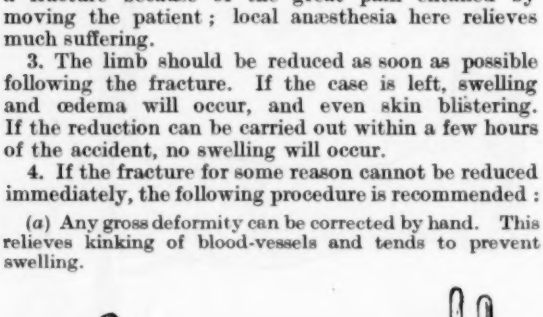

FIG. 7.—Application of Böhler iron.

(*b*) A firm bandage—e.g., Elastocrêpe—should be applied over wool, from the extremity of the limb to above the fracture site. This supports the tissues and prevents swelling.

(*c*) An adequate back-splint should be applied. A padded Cramer wire splint is light and efficient. A back-splint and foot-piece from toes to knee will do nothing but harm to a fracture of the middle or upper third of the tibia.

(*d*) The injured part should be kept elevated above the rest of the body, until adequate reduction can be performed and the fixation cast applied.

If the patient is to walk the same day as his fracture, which is the ideal to be aimed at, the following conditions are essential:

1. The reduction must be performed before the limb has swollen.

2. If the limb has swollen, this must be reduced by elevation, massage, and anodal galvanism, applied by means of pads. A complete plaster cast must never be placed on a swollen limb.

3. The limb must not be shaved before applying the plaster cast.

4. The patient must be seen by the doctor the next day.

5. The printed instructions already described must be given to the patient.

PREPARATION OF BANDAGES FOR USE

1. The total number of bandages required for any particular cast should be determined, removed from their containers and placed in an accessible position facing the operator.

2. All slabs should be made on an armoured glass plate, the most suitable dimensions for which are 40 × 12 ×

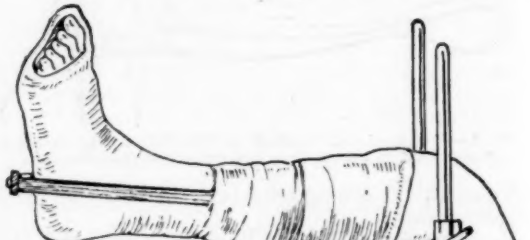

FIG. 8.—Bandage 4 in. wide holding top of iron.

½ in. The glass plate should be placed across the sink and tilted laterally so that any excess of water will run off; otherwise slabs will be too moist.

3. A glass rod, about 11 × ¾ in., is inserted through the cardboard core. The complete bandage is immersed for three seconds in a bowl of tepid water. Both hands should be employed to remove the bandage and squeeze out excess moisture.

4. The loose end of the bandage is held on the glass plate and the bandage unwound by means of the glass rod to the requisite length for the slab. A second thickness is secured by unrolling the bandage on to the first layer, and the operation is repeated until the necessary number of layers are obtained. As the bandage is unwound the layers should be smoothed out by hand to remove all air cavities.

5. The finished slab, now ready for application, is slid off the glass plate on its long axis to avoid drawing the layers apart.

The Below-Knee Cast

1. When swelling has been reduced, the leg is placed as shown in Fig. 1. The bandage, which is held by the patient, is used to keep the foot dorsiflexed.

2. A strip of adhesive felt, 1½ in. wide by ⅛ in. thick, is placed obliquely as shown in Fig. 1; it must be higher anteriorly than posteriorly, to allow full range of flexion later.

3. A slab 40 in. long is made with two 4 in. by 3 yd. bandages. This is applied as a stirrup, from the adhesive felt on the inner side, round the heel, to the adhesive felt on the outer side (Fig. 2). The

slab is rubbed on to the limb and all air bubbles displaced. *This is essential during the whole process of application.*

4. This slab is held in position by applying a wet muslin bandage from above downwards to just above the ankle. This bandage should be of thin gauze

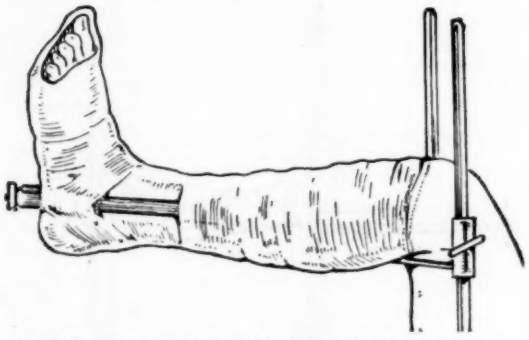

FIG. 9.—Bandage 4 in. wide holding bottom of iron.

1½ in. wide with trimmed edges, and should be rolled on loosely (Fig. 3).

5. A back-slab 40 in. long is now made from two 6 in. by 3 yd. bandages. This is applied working from above downwards, along the calf, over the sole of the foot, and the excess dropped temporarily over the toes. The operator now makes a cut 1 in. long on each side of the ankle-joint, so that the bandage will mould snugly round the ankle and heel (Fig. 4).

6. A 4 in. by 3 yd. bandage is applied in a circular manner from above downwards, a small fold being made in each turn (the crease of the fold coming over the back-slab and *not over the bare area of the tibia*); this allows for the slight contraction of the bandage in setting. The bandage will reach to the ankle-joint.

7. The portion of the back-slab which was thrown over the dorsum of the foot is now doubled back over the plantar surface, making a double support under the toes. This plaster should extend 1 cm. beyond the toes.

8. A second 4 in. by 3 yd. bandage is applied in a circular manner, extending from the ankle to the toe cleft (Fig. 5).

9. A slab 20 in. long is made from half a 4 in. by 3 yd. bandage. This is put round the top of the plaster tightly and held on by using the rest of the bandage. This completes the top of the plaster and makes it firm to stand the weight of the leg.

10. A modified Böhler iron (Bristol pattern, as shown in Fig. 6) is attached to the cast, in the axis of the tibia, and extending two fingers-breadth below the heel. The clearance of the iron must depend on the amount of dorsiflexion able to be produced. If the foot has been fixed in a position of dorsiflexion just over a right angle, two fingers-breadth is the ideal clearance. There must be sufficient height of iron to allow the plaster under the toes to clear the ground.

11. Half a 4 in. by 3 yd. bandage, applied tightly round the cast, holds the top of the iron (Fig. 7). The other half is used to lash the iron to the heel (Fig. 8). Heavy patients will require one whole bandage (4 in. by 3 yd.) in each situation.

Ten minutes after the application of this cast the patient may walk on the iron. He must be given the following instructions:

1. You must walk with a straight knee, and on no account go over on to the toe-support of the plaster, or this will wear out and crack.

2. When not walking you must keep the leg elevated.

3. Read the printed plaster instructions about visiting the doctor.

This is a standard cast for all ankle fractures except Pott's of the third degree. The indications for its use are:

1. Fractures of the metatarsal bones.
2. Fractures and dislocations of the mid-tarsal bones after reduction.
3. Fractures of the os calcis (with certain modifications).
4. Severely torn ligaments of ankle-joint.
5. First and second degree Pott's fractures.
6. Cases which have had operative correction for foot deformities such as Steindler's operation and tendon transplants, subastragaloid arthrodesis. A padded cast is first used for a week.

Number of bandages required ..	6 4 in. × 3 yd. 2 6 in. × 3 yd.
Weight of cast plus iron	2½ lb.

This cast is the standard basis of the long and the short casts, the long casts always being made in two sections, the first section being this standard below-knee cast.

The Mid-Thigh Cast

This is made in two sections, first to the knee as described above, and then to the mid-thigh, with the knee in extension, as follows:

1. A piece of adhesive felt 1½ in. wide and $\frac{3}{16}$ in. thick is placed round the mid-thigh.

2. A slab 30 in. long is made from two 6 in. by 3 yd. bandages. This is applied to the front of the thigh with a small fold back at the upper end from the adhesive felt above, to 8 in. down the tibia. The surplus is cut off and applied over the junction of the two plasters.

3. A back-slab is made from two 6 in. by 3 yd. bandages. This is similarly applied to the back of the thigh.

4. These slabs are fixed to the limb by two 4 in. by 3 yd. bandages applied in a circular manner.

5. A 4 in. by 3 yd. bandage is made into a slab and applied to go round and strengthen the top.

6. When the patient has large thighs it is advisable to apply, in addition, two lateral slabs made from 4 in. or 6 in. bandages, according to the size of the limb.

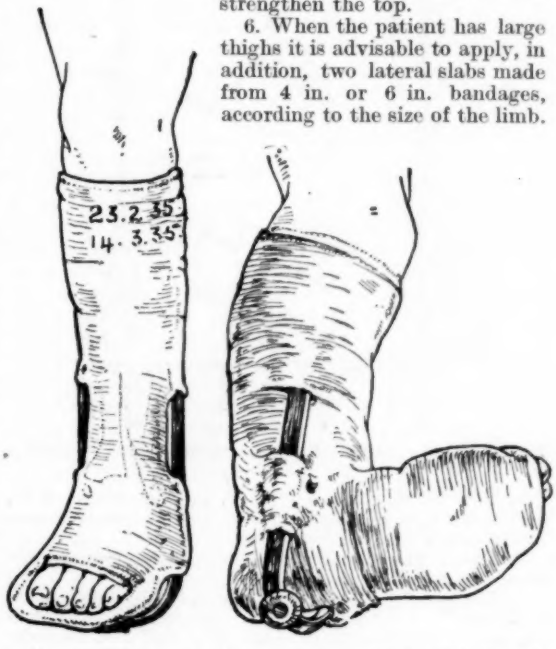

FIG. 10.—Standard below-knee cast completed. Note the date of reduction and the date of removal of cast.

Indications for the mid-thigh cast are:

1. Third degree Pott's fracture.
2. Pott's fracture in corpulent women, where the below-knee cast does not produce sufficient immobilisation to enable them to walk without pain.
3. Fractures of lower third of the tibia.

The Full-Length Walking Cast

This extends from the toes to the tuber ischii and is unpadded except for the top, which is constructed similarly to the top of a walking calliper. This cast is made in two parts. First, the standard below-knee cast is applied with the knee in flexion. The knee is then straightened and the cast continued up to the tuber ischii. The padded ring is made as follows:

A 4 in. by 2 yd. domette bandage is sewn round a ¾ in. roll of grey hospital felt, the felt being cut to the exact length of the circumference of the limb round the level of the tuber ischii.

The padding, which is now in a roll form in the middle of the bandage, is put round the top of the thigh so that it lies in the gluteal fold. It is knotted once over the great trochanter and then carried over the opposite shoulder where it is again knotted.

The cast is made as described below, and during the whole process of application the plaster is being constantly rubbed by the operator's hand to remove air bubbles.

1. Anterior slab, 40 in. long, consisting of two 8 in. by 3 yd. bandages, is applied from the ring at the top to 8 in. down the tibia over the lower cast. The surplus is cut off and put over the junction of the two casts, as before.
2. A similar back-slab is applied.

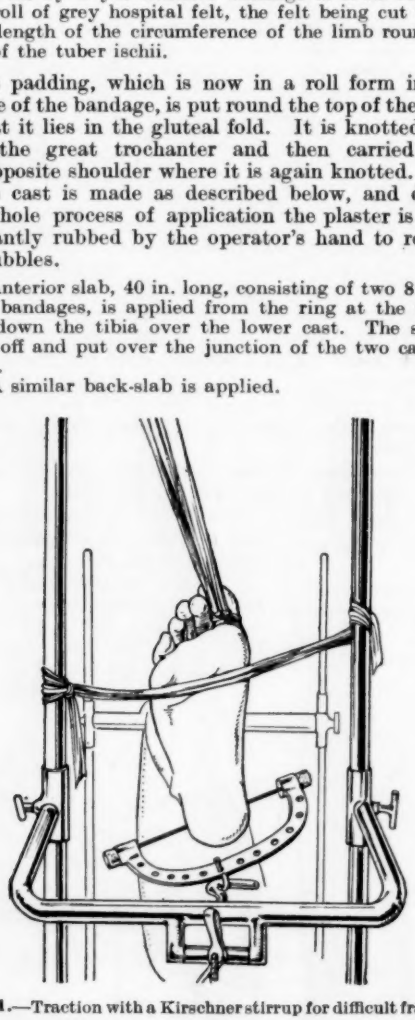

FIG. 11.—Traction with a Kirschner stirrup for difficult fractures.

3. Two lateral slabs are made, each from two 4 in. or 6 in. by 3 yd. bandages, according to the circumference of the thigh.
4. Two 6 in. bandages applied spirally now connect these four slabs together.
5. The top of the cast is now completed by a slab made from a 4 in. by 3 yd. bandage. Before this is applied the ends of the domette bandage are cut off 2 in. from the knot over the great trochanter, and these ends are turned down and incorporated in the plaster.
6. When the cast is dry the top is lacquered to preserve the surface, and enable the cast to be washed when soiled with excretions.

The indications for this cast are: (1) comminuted fractures of lower third of tibia; (2) fractures of mid and upper third of tibia.

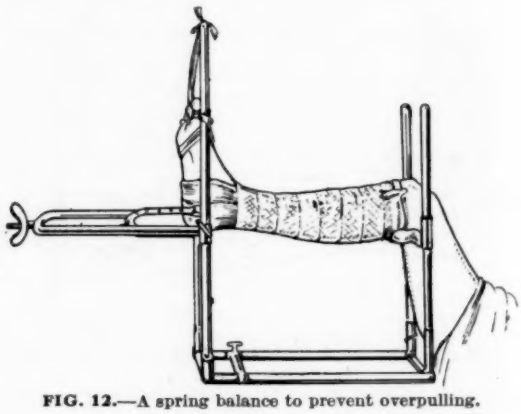

FIG. 12.—A spring balance to prevent overpulling.

Technique in the Swollen Limb

Often the surgeon first sees the case a day or two after the fracture, when the bones have been displaced, there has been a large effusion of blood, and the limb is swollen and œdematous; skin blisters may also be present. Blisters are only seen where the fracture has not been reduced and where a back-splint and foot-piece have been used. In over 800 cases treated by the skin-tight technique, blisters were never seen when the fracture case was reduced within six hours of the accident.

The first treatment should be to clean the skin with ether soap. The leg should never be shaved. If the leg is very flail it should be put straight manually and a firm bandage over wool applied. A padded Cramer wire back-splint is then applied, and the leg kept elevated above the rest of the body till reduction can be performed.

Swelling can be reduced by (1) anodal galvanism by bath or pads; (2) massage in elevation; (3) application of Bier's bandage from below upwards. If the limb at the time of reduction is very swollen a walking plaster must not be applied, because the plaster will rapidly become loose and cease to immobilise the fragments; the patient will then complain of severe pain and will not use the limb.

If the limb is very swollen it is impossible to tell when the bones have been accurately reduced; even if they have been adequately reduced they will become displaced again after the swelling has disappeared, owing to the looseness of the plaster. In such a case a 2/3 plaster is applied, which is kept as light as possible, and removed after the swelling has subsided, in from seven to ten days.

The 2/3 plaster is applied in a similar manner to the standard casts, the only difference being that the circular turns are not used. For instance, in the standard below-knee cast the stirrup-slab is first applied, then the back-slab, and the plaster completed with a wet gauze bandage from the knee to the toe cleft. If the fracture is situated in the lower third the plaster is taken up above the knee—that portion above the knee need not be of the 2/3 variety but can be completed. Swelling is never severe above the first joint above a fracture.

After the cast has set the patient is put to bed and the leg kept elevated for from seven to ten days. The

best splint is Braun's which keeps the leg sufficiently elevated, and the foot of the bed is put on blocks. After seven to ten days this cast is removed and a walking cast applied.

In difficult fractures which need skeletal traction for reduction the leg is placed in the Böhler apparatus after a Kirschner wire has been introduced through the heel (Fig. 11). Screw-traction is applied from the Kirschner stirrup to the tension screw. A spring balance is placed as shown in Fig. 12, to prevent over-pulling. The foot is kept in the correct position thus :

1. The pull is exerted on the outer side of the stirrup to invert the heel.
2. The third toe is slung from the cross-frame.

After the reduction has been performed the limb is supported as shown in Fig. 12, and the standard below-knee cast is applied. Slots are cut in the stirrup and back-slabs, to make room for the Kirschner wire. When the plaster is completed the wire is immediately removed.

Ankle Fractures

1st and 2nd degree ..	Cast is of below-knee type.
3rd degree. Pott's ..	Cast is to mid-thigh.
Fracture of post-articular surface of tibia ..	Cast is to mid-thigh.
Lower third tibia ..	Cast is to mid-thigh.
Mid and upper third tibia	Cast is to tuber ischii.

If for any reason it is undesirable to apply the cast above the knee, a mid-tibial fracture may be adequately immobilised by the introduction of a Kirschner wire through the upper part of the crest of the tibia 2 in. below the knee-joint. The wire strainer and wire must be incorporated in the plaster.

(To be concluded)

MENTAL CARE IN 1934

BOARD OF CONTROL REPORT

IN part I. of its report (H.M. Stat. Office, 1*s.* 6*d.*) for the year 1934, the Board of Control (Lunacy and Mental Deficiency) sound a warning that the incidence of mental disorder is increasing at a greater rate than the provision of accommodation. Minor changes provided 1177 new beds ; the total number of patients increased by 2125 and the number of patients in excess of the authorised bed space on the first day of this year was nearly 2000. This, the Board state, would not in itself be a serious shortage but for the slowing-down of new building. Only one new hospital—for Southend and East Ham—is actually being built and, though several others are in contemplation, they are not likely to be ready for four or five years. The shortage of accommodation may become much more serious, say the Board, before it can be appreciably relieved by new construction. The increase in the total number of patients, however, does not give definite evidence that the incidence of mental disorder is increasing, certainly not to an extent which would justify some of the alarmist statements in the lay press.

Satisfactory progress is reported in the administration of the Mental Treatment Act. The number of out-patient centres established in connexion with public mental hospitals is now 134. The Board single out the admirable work of the Hertfordshire Mental Hospital at Hill End, which in addition to many other beneficent activities has established the St. Albans Nerve Clinic (the old-world name was chosen in deference to public taste) where part-time psychotherapists, with the help of trained social workers, assist in providing a form of treatment for which the permanent medical staff often cannot afford the necessary time. This clinic is a splendid example of organisation on a team-work basis.

The number of voluntary admissions to public mental hospitals increased by 1117 and is now over 4000. Admissions under certificate have decreased by 513. The Board note, however, with some uneasiness that a number of mentally defective children of relatively low grade have been admitted as voluntary patients. It is open to doubt, they remark, whether such cases can legally be dealt with under the Act, and they find it difficult to appreciate the grounds on which medical practitioners have given necessary recommendations. They regard this as an abuse of the Act, calculated to bring voluntary treatment into disrepute, and may decide to order the discharge of such defectives as unfit to remain as voluntary patients. The number of temporary admissions increases slowly, but improvement has been noticeable. Many rate-aided patients continue to be certified although a little more time and trouble would give them the benefit of temporary treatment ; the Board have issued a circular for the guidance of relieving officers and hope that it will lessen the difficulties of this complicated section of the Act.

FALSE ECONOMY

The Board learn with regret that one of the largest authorities in the country has decided to reduce the number of medical staff in some of its hospitals. This step, they declare, is all the more unfortunate because the existing medical staff in most public mental hospitals is inadequate if patients are to receive proper individual attention. They cannot believe that the relatively small saving which can be made by reducing a medical officer here and there can be anything but wasteful in the long run. To expand buildings and to diminish staff is, they say, never economical. They also deplore the gradual diminution in the number of whole-time chaplains in mental hospitals. Visiting committees, they say, tend more and more to arrange with the nearest incumbent to undertake the necessary services in return for a stipend which barely represents the cost of an additional curate. The work is therefore done in a more or less perfunctory way by an already busy incumbent, or else farmed out to an extra curate. They suggest that, although the visiting committee are primarily responsible, yet it is within the competence of the bishop, whose licence is required for the appointment of a chaplain, to consider whether the conditions attaching to the appointment promise that the duties will be adequately discharged. A chaplain who can spend time in the wards and has the tact and sympathy which call for the confidence of patients does work of therapeutic as well as spiritual value. There is an abundant outlet for the energies of a keen chaplain in educational and recreational work. The Board plead that mental hospital appointments should entitle the holder to relief and transfer at the end of a reasonable time, and that good work should receive more recognition in the selection of men for preferment.

The value of occupational therapy is emphasised, and the Board urge the appointment of whole-time organisers. They do not consider that nurses who learn a craft need necessarily receive extra pay ;

craft-teaching adds to the interest of the work and makes the patients easier to handle, and a specially gifted nurse may secure a post as technician or craft-worker, or may undergo training and qualify as an occupational therapist. To give extra pay seems to the Board to approach the matter from a wrong angle and to invest with a special character what should be a matter of routine. The Board also points out the value of recreations and ward gardens, and of hairdressing and dress facilities for restoring the self-respect of women patients.

RESEARCH

The Board received communications from over fifty institutions reporting progress made in various lines of research. Dr. T. C. Graves, of Birmingham, reports that macroscopic evidence of chronic infection of the nasal sinuses was found in 51 out of 81 post-mortem examinations. The amelioration of mental disorder which follows treatment of bodily disease has, he says, been apparent to all who have been in close touch with the patients. He lays stress on the importance of examining sphenoidal sinuses, and again emphasises that until sepsis of the ear, nose, or pharynx has been treated, real progress towards mental and physical recovery is not made. At Warwick it was discovered that operative procedure did not benefit schizophrenia and manic depressive states but benefited certain confusional states. The visiting dental surgeon at St. Andrew's, Northampton, is not satisfied that dental infection is related to the psychoses except in a few cases. Stereoscopic radiography has been carried out on all admissions but no case of sinus infection was detected. Cardiff continues to test all recent admissions for tuberculosis, and Wadsley (Sheffield) finds that the examination of fæces for the tubercle bacillus is invaluable. Of 41 patients with positive results in the fæces the sputum was positive in 9, negative in 8, and in 24 not obtained or unobtainable. At Long Grove no definite difference was found between cases of dementia præcox and controls in respect to tuberculin, and at Norfolk 25 cases of dementia præcox showed negative blood and cerebro-spinal fluid. At Bristol the routine inoculation for dysentery has been continued and the result has again been most gratifying.

At Storthes Hall the Meinicke clarification reaction was found to agree with the Wassermann in nearly 99 per cent. of 229 admissions, and at Long Grove, where four thousand sera have been examined, agreement has been shown with the Wassermann in all types of cases. As the Meinicke test is much more easily performed, this confirmation of its value is most important. At Winwick the presumptive Kahn test proved in a large series of cases to be practically as good an exclusion test with serum as the micro-Meinicke, but St. Albans considers that the Kahn test is not sufficiently reliable to substitute for the Wassermann. At East Sussex the Kahn flocculation is used concurrently with the Wassermann, and close agreement is found; it is considered that the concordance of these tests is of much greater value than one alone. The Wassermann test, according to the Royal Eastern Counties Institution at Colchester, is often unreliable as a test for congenital syphilis, and cases are being re-examined by the presumptive Kahn test.

Dr. Shaw, of Stafford County, makes an interesting report of the state of the kidney in psychotic patients. He has rarely, he says, found a really healthy kidney at autopsy. Of 242 direct admissions in the year, albumin was present in 45 per cent. and more or less persistently in 70 per cent. of these. Mental hospital patients show "almost constant fatty and exhausted livers," which may furnish evidence of strain and failure in detoxication, with resulting effects upon other tissues. At Barnwood House recurrent attacks of excitement, ascribed to sympathetic stimulation, in a schizophrenic patient have been aborted by acetylcholine.

The Exminster Hospital, Devon, reports good results from the paretic patients it has treated by induced malaria. Out of a total of 79 cases, 32 have been discharged and only four have returned to hospital. Fifteen have continued to improve mentally and 12 have reported good physical health. The mental condition of five was stationary and in two was deteriorating. Ten were in regular employment. In all, 54 are alive, but before malarial treatment was introduced no general paralytic survived longer than three years from admission. Dorset reports a remission-rate of 30 to 35 per cent. from tryparsamide and pyrifer, but the Board considers that malaria still holds the field.

Prolonged narcosis is being investigated by several institutions. Cardiff employed somnifaine in most of 107 mixed cases of mental disorder, eliminating toxic symptoms by glucose and insulin. In schizophrenia the best results were obtained in depressed cases, the least satisfactory in catatonic stupor. In manic-depressive cases 37·7 per cent. are said to have recovered as a direct result of the treatment. Dorset, however, did not obtain satisfactory results, and considers the procedure too dangerous for routine use. This hospital has found that manganese chloride intravenously seems to mitigate catatonic symptoms.

Cardiff contributes a long and interesting report on biochemical investigations.

Mental Deficiency

Steady progress is reported by the Board on the mental deficiency side, and during the year 2026 additional beds were provided in certified institutions. Several big schemes are well under way, including Botley's Park. Considering that the Board have during the last four years put no pressure on local authorities, it is remarkable that the rate of progress has been so well maintained. Comparatively few counties have not made at least a beginning with the provision of beds. The transfer of public assistance institutions to the county and county borough councils has materially contributed to the growing realisation of the cost of neglecting mental defect. The review of accommodation necessitated by the Local Government Act, 1929, brought home to local authorities the extent to which the existing poor-law expenditure was traceable to defectives, and showed that to deal with mental defect through the machinery of the poor law was neither efficient nor economical. The position in Wales, particularly North Wales, is, however, still far from satisfactory, and except in Glamorgan there is little prospect of improvement. In the more thinly populated counties in England and Wales alike the position cannot be expected to improve until agriculture is stable and prosperous.

The Board express uneasiness over the notification of defective children by local education authorities. The local mental deficiency authority, they point out, has no power to deal with children between the ages of 7 to 16 unless they have been notified by the local education authority. This authority can only notify ineducable children and feeble-minded children who are leaving special schools or classes, except

where a child could not be taught in a special school without detriment to other children, or the Board of Education certify that there are special circumstances. Special schools have not developed as was anticipated in 1913. Thay are recognised as being impracticable in rural areas and small towns, and even in the larger towns there is sometimes a tendency to merge the feeble-minded and the educational defective with the backward children for educational purposes without certification. This change of policy is in accordance with the recommendations of the Wood Committee, and the Board do not criticise it. Nevertheless, they point out, it clearly restricts in the most unfortunate way the power of local education authorities to notify mentally defective children. The result is that large numbers of defective children who have been retained in ordinary elementary schools cannot be notified when they leave at the ordinary leaving-age, although their defectiveness is well known to their teachers and to the school medical officers. The local mental deficiency authority can do nothing till these children reach the age of sixteen, and then only if they are "subject to be dealt with" under one of the other provisions of the Act. Feeble-minded children are left at a most critical period in their lives without the supervision and control which Parliament intended to give them. Even at the age of sixteen the local mental deficiency authority can do nothing with them unless they are neglected or break the law. Some will find their way into institutions after the opportunity for continuous care and training has been lost, and many will have hardened into delinquent ways. A number who with proper supervision ought not to need institutional care will have got into trouble for want of a helping hand, and some will have so deteriorated that they can no longer be left at large.

The smaller number of notifications from local education authorities may, the Board consider, partly be due to a failure to realise the need of adult defectives for community care, and partly to a lack of provision for care and training outside institutions. Some education authorities are reluctant to take a step which stamps the notified child as being in a class apart. The Board condemn this attitude as wrong, declaring that there is no sharp line dividing the feeble-minded from the dull and backward. The more complicated the social fabric, they say, the greater the need of the defective to have a space found in it for him. Segregation, except for purposes of training, should be a last resort. There is all the difference between a defective left to fend for himself, unprotected and with his weaknesses unrecognised, and one who is given special training, protection, and control. The local authority has the double responsibility of seeing that every defective has proper training and occupation, and of showing the public how to protect mental defectives as they would the cripples and the blind. The expenditure is worth while economically and socially.

CHESHIRE HOSPITALS.—The local authorities in Cheshire have under consideration plans for the provision of adequate hospital accommodation for infectious cases, other than small-pox. Under this scheme a total of 448 beds will be available for a population of 672,781. At present more than half of the 50 county districts have agreements with outside authorities for isolation hospital service and have no control over the hospitals used, and under the new proposals the number of available beds would be increased by 77. It is estimated that the cost will be about £54,900.

MEDICINE AND THE LAW

Alleged Masquerading under Doctor's Name

PROCEEDINGS were instituted at Birmingham earlier in the present month against a man named Ernest Peace Freeman who was alleged to have adopted the name of Dr. Louis Rabinov, a registered medical practitioner residing in Melbourne, Australia. The prosecution stated that Freeman came to Birmingham last year and purchased the practice of Dr. Alexander at Hall Green. He sold it last April to a practitioner from Westcliff-on-Sea for £660. The purchaser afterwards discovered that drugs and fittings had not been paid for. Mr. M. P. Pugh, who prosecuted, said that it had been ascertained that the real Dr. Rabinov was practising in Australia and that Freeman was an impostor who masqueraded under Dr. Rabinov's name. There would, he said, be further charges against Freeman of obtaining £13 worth of drugs and fittings and of obtaining money from the purchaser of the practice and from other persons by the false use of a registered medical practitioner's name. Mr. Pugh added that there had been complaint from the Selly Oak Hospital, Birmingham, that Freeman had been attending lectures in obstetrics at the Dudley-road Hospital and had been examining women. On behalf of the accused it was denied that he had ever been to the Dudley-road Hospital though he seems to have admitted, since his arrest, that his name was not Rabinov, and that he was not a doctor. He was really the owner of the Royal Marine Hotel, Cowes. A police officer told the bench that the real Dr. Rabinov had written a letter which led to investigations. Freeman was remanded on bail till Sept. 26th.

Sequel to Sydney "Shark Arm Case"

We noted previously (THE LANCET, July 6th, p. 40) the quashing of an inquest in Australia on the arm of a missing man believed to have been murdered; the arm had been disgorged by a shark and, though the only part of the corpse to be found, was identified by tattoo marks. The deceased was a boatman who disappeared in April. Soon afterwards a shark, captured in the sea off Sydney and kept alive for a few days in a public aquarium, disgorged the limb. On the day before the inquest proceedings were opened a boatbuilder named Holmes was murdered by unknown men. He had previously made a statement apparently incriminating a third man named Brady as the possible murderer of James Smith. The judge ruled that Holmes's alleged statement was inadmissible against Brady upon the charge of murder. Brady was acquitted. The case is therefore not to be added to the exceptional group of trials where a man has been found guilty of murder in the absence of the corpse.

PARIS

(FROM OUR OWN CORRESPONDENT)

TETANUS IMMUNISATION

LAST week (p. 625) you mentioned the steps now taken to prevent tetanus in the French army. The report of the commission appointed to study the matter is now to hand. The members of the commission, whose president was Dr. Fredet, included Dr. Pierre Duval, Dr. Gosset, Dr. Rouvillois, and Dr. Louis Bazy, who is surgeon to the Saint-

Louis Hospital. Their report to the Société Nationale de Chirurgie is a strong plea for wholesale, systematic, active immunisation with the Pasteur Institute's anatoxin in the place of random passive immunisation with serum, 650,000 ampoules of which were issued by the Pasteur Institute in 1934. To stress the comparative futility of serum treatment, the Commission note that in more than 70 per cent. of the cases of tetanus observed the infection was carried through some trifling injury such as a pin-prick or a superficial scratch, and in more than 6 per cent. the site of entry of the germ was not demonstrable. Tetanus serum is apt to be given too late, but whatever may be decided about the routine use of a vaccine, serum will still have a limited field of action, notably in those cases in which the subject of severe infected injuries has not already been vaccinated against tetanus, and is in need of passive immunisation at once. In such cases the Commission recommend a subcutaneous injection of tetanus anatoxin in the scapular region followed about a quarter of an hour later by a subcutaneous injection of serum in the abdomen or thigh; much importance is attached to these two injections being in different parts of the body. The Commission are in favour of combining tetanus vaccination with the typhoid and paratyphoid vaccination already compulsory in the army. For children, tetanus and diphtheria vaccination could be combined. The Commission are in favour of repeating such vaccination every year or two, in spite of the fact that, according to Ramon and Zoeller, the immunity conferred by tetanus vaccination is still demonstrable five years later.

A SANATORIUM FOR FRENCH STUDENTS

Some ten years ago the late Prof. Léon Bernard declared that French tuberculous students should have a sanatorium of their own. This suggestion bore fruit when a sanatorium, differing in many respects from the typical private or public institution, was built at St. Hilaire-du-Touvet, overlooking a wide expanse of characteristic French scenery. Though this sanatorium began to receive patients two years ago, it was not till this summer that it was officially opened by M. Herriot. On this occasion Dr. Rist drew attention to the revolutionary changes which have come over the régime prescribed for the tuberculous since the days, still in the memory of the present generation, when the physician in charge ambled round from one patient to another, preaching the gospel of the simple life and keeping up his patients' morale. The part he played was so easy that he could manage some 150 patients unaided. In the sanatorium of to-day, the deck chair has been relegated to a position of minor importance, and treatment has become highly technical, active, and operative, with collapse therapy requiring great manipulative dexterity and the aid of many ancillary services, not least those of the radiologist. The sanatorium has also become a centre of scientific research and of teaching—functions which require team-work in a large institution. The small, isolated building is, or should be, as dead as your Queen Anne.

LABORATORY ASSISTANTS

In a recent number of *Concours Médical* Dr. G. Lavalée takes exception to the growing custom of employing untrained young women as laboratory assistants. He would find a place here for the poor medical student who at present earns money by hawking patent medicines or even ushering cinema patrons into their seats in the intervals between lectures and examinations. Dr. Lavalée holds that where important verdicts depend on the accuracy, conscientiousness, and judgment of such assistants, the scientific staff of the laboratory has no right to cover unskilled labour. This staff would doubtless have an answer ready—that supervision is vigilant, that procedures are checked at all stages, and that the interpretation of a result by a medical student working in his spare time is no more likely to be accurate than one by a permanent member of a laboratory staff, however superficial is her knowledge of pathology. Dr. Lavalée's plea for the employment of needy medical students in laboratories may impress their directors, but surely not to the point of dismissing a single competent employee.

IRELAND

(FROM OUR OWN CORRESPONDENT)

THE TASK OF THE HOSPITALS COMMISSION

A REPORT of the Irish Hospitals Commission was presented to the Minister for Local Government and Public Health early in the summer, but up to the present no information has been given as to its contents. The secretary of the commission has, however, addressed a letter to certain local authorities in which a little light is thrown on the present position of the commission's labours. He states that, in accordance with the Public Hospitals Act, 1933, a survey of hospital facilities in the Irish Free State is being made. The survey has been completed as regards voluntary hospitals, and much valuable information has been acquired. As no survey of hospital facilities would be complete without the inclusion of hospitals, infirmaries, and sanatoriums under the control of local authorities, the upkeep of which was provided mainly out of rates, a questionnaire is being issued, asking the average number of patients, number of beds, numbers admitted and discharged during the year, average cost, and other matters. The questionnaire has been designed to elicit information regarding all types of hospitals and institutions under the control of local authorities, which provide facilities for housing and treating the sick.

THE LATE DR. J. T. ELLIOTT

The death is announced of Dr. John Trimble Elliott, of Smithborough, the doyen of the medical profession of County Monaghan and one of the most respected of country practitioners in Ireland. Dr. Elliott qualified 54 years ago and has spent nearly all his professional life as dispensary medical officer of Smithborough. A modest and unassuming man, he had a fund of shrewd common sense which made his services much sought after on both professional and lay committees. He took an active part in medical organisation and was for many years a member of the council of the Irish Medical Association and honorary secretary for his county. He was also a strong supporter of the Royal Medical Benevolent Fund.

LLANELLY HOSPITAL.—The total income for this hospital last year was £11,809, the highest figure yet reached, and the patients admitted numbered 3809, an increase of 555 over the previous year. Expenditure amounted to £10,657, so that the excess of income over expenditure was nominally £1152, but actually after allowing for depreciation only £684. A new nurses' home is being built and, apart from equipment, will cost over £11,000.

PANEL AND CONTRACT PRACTICE

The Drug Habit

LAST year the average chemist's bill of an insured person was 2*s*. 11*d*., a halfpenny less than in 1933. The curious thing is the extent to which this figure varies in different parts of the country. According to a report presented to the Association of Welsh Insurance Committees in session at Barmouth earlier in the month Manchester and Salford head the list with 4*s*. 10*d*. In his report for 1933 Sir George Newman mentioned the twenty insurance committee areas in England with the highest drug costs, stated in pence and decimals of a penny. In descending series these were: Manchester, 58·139; Salford, 57·863; Rutland, 50·027; Barrow-in-Furness, 49·031; Kingston-upon-Hull, 47·392; Oldham, 46·673; Preston, 45·887; Leeds, 44·654; Southend-on-Sea, 44·558; Blackburn, 44·000; Gateshead, 43·194; Stockport, 43·112; Liverpool, 42·500; South Shields, 42·475; Bury, 41·604; Birkenhead, 41·217; Newcastle-on-Tyne, 40·987; Birmingham, 40·849; Lancashire, 40·362; Cheshire, 40·224. It must excite surprise that such a health resort as Southend-on-Sea should be so high up on the list. London took fifty-third place with 35·75 pence per insured person, while the area in England with the lowest cost was Oxford with 21·99 pence. Districts though neighbours geographically may be found far apart in the tables: for instance, Gateshead 43 pence, Middlesbrough 29 pence; Kingston-upon-Hull 47½ pence, Grimsby 29½ pence. The figures for Wales varied from 21·14 pence in Radnor up to 36·62 pence in Caernarvon, the average for the principality being 32·19 pence. In Scotland, apart from Zetland where the cost was 45·1 pence, the most expensive area cost only 34·02 pence. But, lest it be assumed that insured persons in Scotland do not receive their fair share of physic, it should be recalled that in Scotland medicines required for the treatment of insured persons with tuberculosis are provided by the local authority and not out of the insurance committee's drug fund.

In Scotland too doctors have never adopted the custom of dispensing medicines for their patients and a bottle of medicine has not become the necessary corollary of a visit to the doctor. In England, for generations past, doctors with very few exceptions have dispensed all medicines for their wage-earning patients who have come to regard a visit to their doctor as synonymous with the receipt of medicine. As a result the cost in England of providing medicine per head of insured population regularly exceeds that in Scotland by approximately 50 per cent. Part of the increase in the cost of supplying medicine to the insured population is no doubt due to expensive forms of treatment such as insulin and liver extract, which have been introduced in recent years. The very fact that new methods of treatment are yearly being made available renders it incumbent on all concerned to utilise available funds to the best advantage. It will be observed that, among the first 20 places in order of expense, 11 are held by the county of Lancashire, probably a sequel to an old county custom for the household to have a standing account with the doctor on which an amount was paid weekly to a collector. They believed in a bottle of medicine and insisted on getting it and paying for it. When national insurance was first introduced suspicion of the Act caused many Lancashire people either to make no selection of doctor or to pay for their medicine through other sources. But when the economic depression came they had no option but to look to their insurance doctor for the medicine which they thought they required. Variation in prescribing cost might be due partly, as Sir George Newman has suggested, to the teaching of particular medical schools, and the adoption of these views in practice by students after qualification, but the examples of Lancashire and Scotland do not support that. What the Welsh association made of these figures we shall await with interest. At present there is no generally accepted explanation of the extraordinary variations in prescribing costs in comparable areas. There is also no evidence, so the late C.M.O. says, that in those areas where the habit of taking medicine is highly developed a more satisfactory standard of health has been achieved.

Tuberculosis in Wales

The importance of early notification of tuberculosis was emphasised by the chairman of the Welsh Board of Health, Mr. John Rowland, in an address to the Welsh Association of Insurance Committees. The success of the work of the Welsh National Memorial Association obviously depends on getting hold of cases in the early stages of the disease. The tuberculosis death-rate was, he said, steadily falling in Wales—the rate for 1934 was the lowest on record—but not as quickly as in England and Scotland, where the death-rate was 20 per cent. lower. Economic distress in the principality might have been one factor in retarding progress, but the greatest improvement had occurred, generally speaking, in the western counties of Wales, where tuberculosis mortality had always been high. In the subsequent discussion Mr. J. E. Tomley of Montgomery related some important evidence. The tuberculosis physician for Cardiganshire, after referring to the serious increase in the number of deaths from tuberculosis in that county, had, he said, admitted that out of a total of 61 deaths in 1934 there were 30 which had not been referred to the Association's officer. He also stated that in reply to the usual questionnaire no reason was given in 18 cases. In Montgomeryshire, on the other hand, there were no non-notified deaths, and the death-rate in that county was the lowest recorded. The report from Anglesey and Caernarvonshire showed that out of 206 persons who died from tuberculosis in that area during 1934 only 158 were seen by the Association during life, and 35 died of phthisis within three months of being first seen; a good proportion of these were insured persons, and the tuberculosis physician hesitated to credit the whole blame to the acuteness of the disease. The same seems to be true in measure of some other Welsh counties. The Association, through its individual insurance committees, is appealing to insurance practitioners for their help in the matter.

Surgical Spirit

Some confusion still exists in the minds of doctors and of chemists as to the effect of changes made by the Board of Customs and Excise in the regulations about surgical spirit. This cannot now be obtained over the chemist's counter. If a doctor wishes to obtain it for his patient he must issue a prescription requiring the chemist to provide Spiritus Antisepticus of the National Formulary or, alternatively, he may write out the prescription in full. The Ministry, after consultation with the Insurance Acts Committee, recently issued an explanation to both doctors and chemists which provides that

where the term "surgical spirit" is used in a National Health Insurance prescription without qualification, it should be interpreted to mean the formula under Spiritus Antisepticus (Surgical Spirit) in the National Formulary, 1933.

The B.P. Codex, 1934, contains two formulæ for Spiritus Chirurgicalis B.P.C., and where a doctor orders Surgical Spirit No. 1 or Surgical Spirit No. 2 his intention has to be interpreted to mean formula No. 1 or formula No. 2 as the case may be. These formulæ were approved by the Board of Customs and Excise as from March 15th, 1934. Both formulæ contain industrial methylated spirit, castor oil, and diethyl phthalate. The former, in addition, contains methyl salicylate and the latter mineral naphtha. The difference between the two formulæ will be immediately obvious to the patient, and doctors have accordingly been advised carefully to specify in their prescriptions the particular formula they desire. In addition to the two forms of Spiritus Chirurgicalis there are also two forms of industrial spirit—namely, Spir. Meth. Indust., B.P., 1932, and Spir. Meth. Indust. sine Aceton., B.P.C., 1934. Practitioners are reminded that the latter preparation is preferable for surgical purposes, as it is compatible with iodine. The former, when brought into contact with iodine, produces an irritating compound by reaction between the iodine and acetone.

To put the position briefly, prescriptions will be interpreted as follows: Surgical Spirit=Spiritus Antisepticus (N.F.). Surgical Spirit No. 1=Spiritus Chirurgicalis, B.P.C., 1934, formula No. 1. Surgical Spirit No. 2=Spiritus Chirurgicalis, B.P.C., formula No. 2. It is hoped that the next edition of the National Formulary will provide that in the absence of any directions from the prescriber Surgical Spirit No. 1 shall be dispensed when surgical spirit is prescribed. Further, it will probably be laid down that acetone-free industrial methylated spirit shall be used for all formulæ unless otherwise directed by the prescriber. Unless and until such provision is made, however, the position will be as here indicated.

OPENING OF THE MEDICAL SCHOOLS

In connexion with the opening of the session at the London medical schools the following arrangements have been made:—

Charing Cross Hospital

A post-graduate course for former students will be held on Oct. 5th and 6th. The annual dinner will take place at the Café Royal at 8 P.M. on Saturday, Oct. 5th, with Rev. A. W. Oxford, M.D., in the chair. On Friday, Oct. 25th, at 4 P.M., Sir Kingsley Wood will distribute the prizes and deliver an address.

Guy's Hospital

On Tuesday, Oct. 8th, at 3 P.M., Sir Kingsley Wood will deliver the inaugural address. The biennial dinner will be held at the Connaught Rooms, Great Queen-street, W.C., on Nov. 15th at 7 P.M., with Mr. A. W. Ormond in the chair.

King's College Hospital

On Saturday, Oct. 5th, from noon to 6 P.M., and on Sunday morning there will be lectures and demonstrations open to all practitioners. Post-graduate lectures on tuberculosis will also be delivered in the lecture theatre of the medical school on Thursdays at 9 P.M. from Oct. 3rd onwards. The annual dinner of past and present students will be held on Oct. 5th at the Mayfair Hotel at 8 P.M., with Sir Charlton Briscoe in the chair. On Oct. 10th Dr. G. F. Still will deliver the inaugural address.

London Hospital

A post-graduate course for former students of the hospital will be held from Oct. 16th to 19th. The old students' dinner will be held on Thursday, Oct. 17th, at 7.30 P.M., at the Trocadero Restaurant, with Prof. H. M. Turnbull in the chair.

Middlesex Hospital

A post-graduate course for former students of the hospital will be held from Sept. 28th to Oct. 1st. On Oct. 1st the annual dinner will be held at the Savoy Hotel at 7.30 P.M., and Dr. H. Campbell Thomson will be in the chair.

Royal Free Hospital

On Tuesday, Oct. 1st, at 3 P.M., the inaugural address will be delivered by Sir Walter Moberly. The annual reunion dinner of the old students will be held on Nov. 28th at the Savoy Hotel, when Dr. Letitia Fairfield and Commander Stephen King-Hall will be among the guests of honour.

St. Bartholomew's Hospital

On Tuesday, Nov. 5th, the old students' dinner will be held at 8 P.M. in the College Hall, Charterhouse-square, with Mr. W. Girling Ball in the chair. The Prince of Wales will be present.

St. George's Hospital

On Wednesday, Nov. 13th, Lord Macmillan will give an address at the annual prize-giving which will be held in the board room at 3 P.M. The annual dinner will take place the same evening at Claridge's Hotel at 7.30 P.M.

St. Mary's Hospital

A week-end post-graduate course will be held from Sept. 27th to 29th, open to all medical practitioners without fee. The annual dinner of past and present students will take place at Claridge's Hotel on Sept. 28th at 7.30 P.M., with Dr. Duncan Fitzwilliams in the chair.

St. Thomas's Hospital

Sir Cuthbert Wallace will preside at the old students' dinner, which will take place at the Dorchester Hotel at 7.45 P.M. on Oct. 4th.

University College Hospital

On Tuesday, Oct. 1st, at 4 P.M., a reception will be held in the library of the medical school. The annual demonstrations for old students will take place on Oct. 10th and 11th, and the annual dinner will be held in the library of the medical school on Oct. 11th at 7.30 P.M., with Sir George Welch in the chair. The annual dinner of the Women's Association will be held at the Piccadilly Hotel, W., at 8 P.M., on the same day, and Dr. Annis Gillie will preside.

Westminster Hospital

On Monday, Sept. 30th, at 3 P.M., the winter session will open at the Caxton Hall, Westminster, when Major Ian Hay Beith will deliver the inaugural address. He will speak on the Privileged Profession. A short course, open to all medical practitioners, will be held on Sept. 28th and 29th, and the annual dinner of past and present students will take place at the Trocadero Restaurant on Saturday, Sept. 28th, when Dr. Vivian Orr will be in the chair.

Royal Dental Hospital

Prizes will be distributed at the hospital on Friday, Oct. 4th, at 8 P.M., at a conversazione at which Sir Francis Acland will preside. The annual clinical At Home will be held at the hospital on Nov. 23rd, and the dinner of past and present students will take place on the same evening at the Trocadero Restaurant, at 7.30 P.M., with Mr. Herbert Smale in the chair.

Further details of post-graduate courses will appear in due course in our Medical Diary.

CORRESPONDENCE

VACCINATION ON THE THIRD DAY

To the Editor of THE LANCET

SIR,—I am writing to draw attention to the harm which so often results from vaccination during the first three weeks of an infant's life. The infant is struggling, at this time, to adjust itself to its surroundings, and it is only with care and help that a steady gain in weight, and normal adjustment, can be maintained. It has long been the custom to punctuate this trying first month by first a circumcision and then vaccination. The number of infants' lives which have been lost as a result of these two procedures must be very large.

I am informed that it is the custom at one large maternity hospital to vaccinate infants on the third day, as a routine. Baby S. was born at that hospital on August 21st, vaccinated on August 24th, became deeply jaundiced on August 26th and 27th, with an enlarged liver and spleen, and was admitted to Great Ormond-street, under my care, on the tenth day after birth. The child had a fever, a tremendous reaction to the vaccination on the left arm, the stools were unhealthy, and the blood showed a marked hæmolytic anæmia. As the vaccination subsided, the liver and spleen grew smaller, the temperature dropped, and the baby commenced to gain weight.

Surely this pernicious practice of adding to the baby's difficulties deliberately, by such early vaccination, should be widely condemned? Although I am completely in favour of vaccination, I think that three or four weeks of age, in a perfectly normal healthy infant, should be the very earliest time for this, and very often it should be left still later, until the gain in weight is definitely assured and the baby doing well.—I am, Sir, yours faithfully,

DONALD PATERSON.

Devonshire-place, W., Sept. 11th.

PERFORATION OF THE ŒSOPHAGUS BY A SWALLOWED FOREIGN BODY

To the Editor of THE LANCET

SIR,—The following case is of interest in view of the paper on this subject by Mr. John E. G. McGibbon in your last issue.

In July, 1934, a girl of 5 attended with a history of having swallowed a fish-bone four days previously. She had been seen at another hospital immediately after, but nothing was apparently detected or done. Since then there was dysphagia, and the child could not swallow at all on account of the pain and the obstruction. Her head was held rigidly to the left side (as in acute torticollis) with pain on that side of the neck low down, over the cricoid region, where an area of tenderness could be defined. There was no palpable cervical swelling. The patient was coughing up pus and was ill. The temperature was 103° F. On mirror laryngoscopy there was a collection of pus behind and over the larynx. Clinical and radiological examination of the chest was negative. X ray of the œsophagus revealed no foreign body. A bismuth swallow passed down without any hitch.

Under general anæsthesia, preceded by a preliminary premedication with rectal paraldehyde, an endoscopic examination was carried out. The larynx was normal, but fœtid pus welled up from the hypopharynx. There was no retropharyngeal abscess. The œsophagoscope was introduced for about one inch below the cricoid. The pus—fœtid and in large amount—was completely removed. It originated from a retro-œsophageal abscess and entered the œsophagus through a punctured wound, marked by granulations, in the posterior wall. The abscess was emptied by gentle pressure of the beak of the œsophagoscope.

A large rigid spiked fish-bone jutted out for about half an inch, in an antero-posterior direction, from the perforation in the œsophagus. When gripped with forceps it could not be moved, being apparently firmly impacted. The grip on the bone was released. By the time an immediate second attempt was made to grip this bone it had completely disappeared. At this stage no further pus was present in the œsophagus or in the retro-œsophageal abscess. The manipulations lasted 20 minutes.

The sudden and complete disappearance of the bone in view of the impaction was mystifying. It was never traced, though the fæces were examined subsequently. Convalescence was uneventful, and within a week the child left the hospital. When seen about six months later she had remained well.

I am, Sir, yours faithfully,

London, W., Sept. 14th. N. ASHERSON.

BACTERIOLOGY OF RHEUMATISM

To the Editor of THE LANCET

SIR,—Dr. Poynton has inspired all those who learned at his knee with affection and respect, and I would not lightly attempt to detract in the least from his just claim that he and Dr. Paine were the first to grow in pure culture the diplococcus of rheumatism, but in June, 1887 (Brit. Med. Jour., i., 1381), Dr. A. Mantle states:—

> A typical case of acute rheumatism being under his care, under strict aseptic precautions, and by means of a sterilised hypodermic syringe, about a drachm of serum was withdrawn from the knee-joint. Several sterilised tubes of gelatinised meat infusion were at once inoculated and in each tube a copious growth took place. . . . He had found two kinds of bacteria, a micrococcus and a small bacillus. Cover-glass preparations of blood and serum showed micrococci as single cocci or pairs (diplococci).

Dr. Mantle found a variety of organisms in various cases and he figures these in illustrations in this article, but it seems to me that the quotation from his original communication confirms my statement in the Ingleby lecture that Dr. Mantle reported a growth of diplococcus from a case of rheumatism.

I am, Sir, yours faithfully,

Edgbaston, Sept. 11th. K. DOUGLAS WILKINSON.

MALARIA AND RACIAL EXTINCTION

To the Editor of THE LANCET

SIR,—The *Ceylon Observer* of July 6th, under the title "Wiped out by Malaria?" refers at some length to my paper on The Muruts of North Borneo in your issue of May 25th, and to your comment upon it. The *Observer* draws a comparison between the problems of malaria and depopulation in Ceylon and in North Borneo, and concludes that in Ceylon, where conditions are more favourable, there is no danger of the increase in population becoming permanently arrested as a result of the recent malaria epidemic. This view is based to some extent on the theory that primitive races have a tendency to languish. But while this may apply to small isolated tribes, such as tree Negritoes or Sakais, it seems to me unnecessary to invoke such imponderable influences when other factors are so obvious.

In brief but illuminating phrases the *Observer* gives a vivid insight into the terrible results of a mass infection of a non-immune population with virulent strains of malarial parasites:—

> "Appalling . . . ravages. . . . The number of deaths a month has indeed been large enough to justify some of the scare headings in the sensationalist sections of the London Press . . . whole families wiped out and many a village left with no more than a single child in it. . . ."

The Murut tribes of Borneo endured such a saturation infection (the Germans call it *Durchseuchung*) some eight to ten years ago, since when their numbers have progressively declined, until now I doubt if more than 12,000 are left of the 22,000 numbered in the 1931 census. In my opinion they would have suffered far less, and their numbers would have been maintained, had they been spared what is nothing less than quinine deprivation from the very outset of their first new infection. That these unfortunate but trusting and obedient natives should make long journeys in the hope of obtaining vital supplies of quinine and dressings, only to be put off with two or three quinine capsules, a small strip of lint, one-third of a bandage, and a little liniment in the palm of the hand is very pathetic, and it was distressing to have to refuse them an adequate supply of quinine.

The Muruts are interesting to ethnologists, and they are even capable of performing useful labour on estates, when they have received proper treatment for splenomegaly, hookworm, and lesser complaints. Governments would seem to become interested in their aboriginal peoples sometimes only when it is too late to save them, and the Muruts are still going through the stage of being interesting only for revenue purposes. The alternatives to the annual ungraduated cash poll-tax of $1.00—i.e., 2*s*. 4*d*.—for every male adult are (1) payment of a fine of five times the tax, (2) two weeks' rigorous imprisonment, (3) "voluntary" heavy work as coolie bearers for three days, for which they must bring their own food. The imposition of poll-tax on a declining population *must* accelerate the decline. I am, Sir, yours faithfully,

Whiston-street, E., Sept. 9th. A. J. COPELAND.

BILIARY DRAINAGE

To the Editor of THE LANCET

SIR,—I was specially interested in one observation made in the article on biliary drainage by Dr. T. Hunt in THE LANCET of last week. He says that the introduction of magnesium sulphate directly into the duodenum is almost always followed by a flow of bile from the common bile-duct. If this bile is removed by tube there is seldom diarrhœa (the magnesium sulphate presumably remains in the intestines). This observation adds weight to a theory as to the mode of action of magnesium sulphate which I mentioned in THE LANCET of Jan. 26th, and also mentioned by Dr. Hunt last week in his article. I suggested that it depended on the increased flow of bile which follows its administration by mouth.

The purgative action of magnesium sulphate has been proved not to be due to its effect after absorption into the general circulation. It is not due to its osmotic effect because Dr. A. F. Hurst has shown that the watery stool does not contain an excess of sulphate. Also if charcoal is given by mouth a short while before the sulphate the charcoal does not appear in the stool which follows. I find that if fresh bile is given by mouth it acts as a strong purgative and preparations of bile salts which are given with the object of causing a greater flow of bile frequently give rise to diarrhœa. Also fresh ox bile given per rectum increases peristalsis in cases of ileus.

These facts suggest that the chief effect of magnesium sulphate may be an increased peristalsis of the large intestine following an increased flow of bile.—I am, Sir, yours faithfully,

D. LINCOLN LEWIS.

Archway Hospital, Highgate, Sept. 17th.

INFECTIOUS DISEASE

IN ENGLAND AND WALES DURING THE WEEK ENDED SEPT. 7TH, 1935

Notifications.—The following cases of infectious disease were notified during the week: Small-pox, 0; scarlet fever, 1924; diphtheria, 1003; enteric fever, 85; acute pneumonia (primary or influenzal), 336; puerperal fever, 36; puerperal pyrexia, 131; cerebro-spinal fever, 14; acute poliomyelitis, 18; polio-encephalitis, 1; encephalitis lethargica, 8; dysentery, 12; ophthalmia neonatorum, 89. No case of cholera, plague, or typhus fever was notified during the week.

The number of cases in the Infectious Hospitals of the London County Council on Sept. 13th was 2641, which included: Scarlet fever, 794; diphtheria, 949; measles, 44; whooping-cough, 403; puerperal fever, 32 mothers (plus 13 babies); encephalitis lethargica, 271; poliomyelitis, 14. At St. Margaret's Hospital there were 21 babies (plus 3 mothers) with ophthalmia neonatorum.

Deaths.—In 121 great towns, including London, there was no death from small-pox or enteric fever, 4 (0) from measles, 2 (0) from scarlet fever, 14 (4) from whooping-cough, 22 (3) from diphtheria, 67 (3) from diarrhœa and enteritis under two years, and 17 (2) from influenza. The figures in parentheses are those for London itself.

Deaths from diarrhœa and enteritis were distributed over 28 great towns, the highest numbers being Liverpool 10, Nottingham 8, Hull 7, Birmingham 5, Manchester 4, Leeds and Sunderland each 3, no other great town more than 2. Birmingham reported 2 deaths from measles. Four cases of diphtheria proved fatal at Manchester, 2 at Bradford.

The number of stillbirths notified during the week was 268 (corresponding to a rate of 45 per 1000 total births), including 50 in London.

MEDICAL NEWS

King's College Hospital

The Duke of York has accepted the presidency of King's College Hospital in succession to the Duke of Connaught.

A Victorian centenary loan exhibition is being planned for the year 1937 to celebrate the centenary of the accession of Queen Victoria. The exhibition will be mainly illustrative of women's activities during the reign. The proceeds will be given to the hospital, which was founded two years after Queen Victoria's accession.

Society of Apothecaries

Sir William Willcox has been elected the new Master of this society and Mr. A. P. Gibbons and Mr. Hugh Lett Wardens.

Society for the Study of Inebriety

The next meeting of this society will be held in the rooms of the Medical Society of London (11, Chandos-street, London, W.) on Tuesday, Oct. 8th, at 4 P.M., when Dr. Gerald Slot will open a discussion on the medico-legal aspects of drunkenness.

Society of Public Analysts

A meeting of this society will be held on Wednesday, Oct. 2nd, at the rooms of the Chemical Society, Burlington House, Piccadilly, London, W., at 8 P.M. The papers to be read include one on the chemical examination of furs in relation to dermatitis (identification of vegetable and other dyes) by Mr. H. E. Cox, D.Sc.

Wireless Sets for Hospitals

The King and Queen have given £150 to the fund to equip voluntary hospitals in Scotland with wireless sets.

British Red Cross Society

Two courses of lectures and demonstrations on anti-gas precautions and first aid for air-raid casualties will be held at the County of London headquarters of this society, 9, Chesham-street, S.W., on Fridays, one at 2.30 and another at 8 P.M. from Oct. 4th onwards. Each course consists of seven lectures and demonstrations. Applications for tickets should reach the county secretary of the branch not later than Sept. 28th.

Mr. Wilfred Trotter, F.R.S., will deliver a Lloyd Roberts lecture on General Ideas in Medicine at the Royal Society of Medicine on Monday, Sept. 30th, at 5 P.M.

Charing Cross Hospital

On Thursday, Nov. 28th, at 5 P.M., Prof. Edward Mellanby, F.R.S., will deliver the Huxley lecture in the medical school. Invitations may be obtained on application to the secretary of the school.

Royal Eye Hospital

A research scholarship tenable at this hospital is shortly to be awarded. Preference will be given to a candidate who proposes to undertake research on a clinical subject. Further particulars will be found in our advertisement columns.

Food Poisoning at Swansea

On Thursday of last week a thousand children were entertained to a feast in the Market Hall, Swansea, by the transport company's employees, and more than 150 of these children suffered from acute gastric disturbance, although only one child, a girl of 13, needed hospital treatment. The suspect article of food was fresh minced meat presented by local butchers, samples of which are being examined by the pathologist of Swansea Hospital.

Leeds Public Dispensary and Hospital

A series of post-graduate lectures, open without fee to all members of the medical profession, will be given during the winter. They will be held every Wednesday at 4 P.M. at the dispensary, and the following members of the honorary staff will take part: Mr. A. D. Sharp, Mr. A. Gough, Dr. H. H. Moll, Dr. S. J. Hartfall, Dr. H. G. Garland, Mr. L. N. Pyrah, and Dr. H. B. Pope. Particulars of the course will appear weekly in our Medical Diary.

Mental Health Congress

The fourth biennial conference on mental health arranged by the National Council for Mental Hygiene will be held at the Caxton Hall, Westminster, London, S.W., from Jan. 23rd to 25th, and will be opened by the Duke of Kent. The subjects which will be discussed include mental hygiene and international relations, the organisation and correlation of mental health services in local areas, problems of marriage and the establishment of courts of domestic relations, and the priest and the doctor in the treatment of nervous and mental disorders. The last day will be devoted to a discussion of Education for Living under the following headings: Mental Health; Those First Eight Years; "Moulding" the Mind: Eight to Fourteen; The "Finished" Product: Fourteen Onwards. The secretary of the council may be addressed at 78, Chandos House, Palmer-street, London, S.W.1.

Medical Diary

LECTURES, ADDRESSES, DEMONSTRATIONS, &c.

ST. MARY'S HOSPITAL, W.

FRIDAY, Sept. 27th.—10.15 A.M., Dr. D. H. Brinton: Some Common Neurological Problems of General Practice. 11 A.M., Mr. Leslie Williams: Hormone Therapy in Gynæcology. Noon, Dr. A. F. Hurst: Some Functional Disorders of Digestion. 2.15 P.M., Dr. A. Hope Gosse: Electrocardiograms. 3.15 P.M., Mr. R. M. Handfield-Jones: Diagnosis and Treatment of Urinary Calculi. 4.15 P.M., Dr. Duncan Fitzwilliams: The Modern Treatment of Carcinoma of the Breast.

SATURDAY.—10.15 A.M., Dr. T. C. Hunt: Popular Remedies, New and Old. 11 A.M., Mr. Aleck Bourne: Has Antenatal Care Failed? Noon, Dr. Reginald Miller: Slimming Problems. 2.15 P.M., Mr. V. Zachary Cope: Four Symptoms in Search of an Author. 3.15 P.M., Dr. H. Courtney Gage: X Ray Diagnosis of Organic Lesions of the Alimentary Tract.

SUNDAY.—10.15 A.M., Mr. A. Dickson Wright: Diagnosis and Treatment of Minor Rectal Condition. 11 A.M., Dr. C. M. Wilson Medical Reasons for Terminating Pregnancy. Noon, Prof. Henry Cohen: Parkinsonism. (Open to all medical practitioners without fee.)

MIDDLESEX HOSPITAL.

SATURDAY, Sept. 28th.—2.30 P.M., Dr. B. W. Windeyer: Types of Cases Suitable for Radium Therapy. 3.45 P.M., Dr. H. L. Marriott and Dr. A. Kekwick: New Method for Continuous Transfusion of Saline or Blood.

SUNDAY.—10.15 A.M., Dr. A. A. Moncrieff: Measures for Prevention of Specific Fevers. 11.15 A.M., Mr. D. H. Patey: Recent Advances in Diagnosis and Treatment of Intestinal Obstruction. 12.15 P.M., Mr. R. Affleck Greeves: Treatment of Conjunctivitis and Other Common Eye Conditions. (For former students of the hospital.)

WESTMINSTER HOSPITAL.

SATURDAY, Sept. 28th.—10 A.M., Mr. A. Tudor Edwards and Dr. W. E. Lloyd: Treatment of Pulmonary Tuberculosis. 11.45 A.M., Dr. R. J. V. Pulvertaft and Dr. N. F. Maclagan: Diabetes.

SUNDAY.—10.15 A.M., Dr. Adolphe Abrahams: The Physical and Psychological Basis of Disease. 11.15 A.M., Dr. Reginald Lightwood: Some Practical Points in the Diagnosis and Treatment of Disease in Childhood. 12.15 P.M., Mr. Stanford Cade: The Earlier Diagnosis of Accessible Cancer. (Open to all medical practitioners.)

FELLOWSHIP OF MEDICINE AND POST-GRADUATE MEDICAL ASSOCIATION, 1, Wimpole-street, W.

MONDAY, Sept. 23rd, to SATURDAY, Sept. 28th.—WESTMINSTER HOSPITAL, S.W. All-day course in medicine and surgery.—BROMPTON HOSPITAL, S.W. All-day course in chest diseases.—ROYAL WESTMINSTER OPHTHALMIC HOSPITAL, Broad-street, W.C. Sat. and Sun. course in ophthalmology.—Courses are open only to members and associates of the Fellowship.

ROYAL INFIRMARY, MANCHESTER.

TUESDAY, Sept. 24th.—4.15 P.M., Dr. Charles S. D. Don: High Blood Pressure.

FRIDAY.—4.15 P.M., Mr. D. L. Sewell: Demonstration of Malignant Disease of the Nose and Throat treated by Radium.

Births, Marriages, and Deaths

BIRTHS

MITCHELL.—On Sept. 9th, the wife of S. F. Mitchell, M.R.C.S. Eng., of Beckley, Sussex, of a daughter.

MUIR.—On Sept. 17th, at Hull, the wife of David Clark Muir, M.D., F.R.C.P., of a son.

OAKDEN.—On Sept. 8th, at Cambridge, the wife of G. F. Oakden, M.B. Camb., of a daughter.

ROBINSON.—On Sept. 9th, at Kingston-on-Thames, the wife of R. D. Robinson, M.B. Lond., of a son.

MARRIAGES

BEATTIE—BADDELEY.—On Sept. 11th, at Reigate, William John Hunt Montgomery Beattie, M.D. Camb., F.R.C.S. Eng., to Marjorie Gertrude, only daughter of Mr. Bernard Baddeley, Reigate Heath, Surrey.

BRAITHWAITE—FAWCETT.—On Sept. 7th, at St. George's, Campden Hill, Edward Braithwaite, B.M. Oxf., of Egremont, Cumberland, to Barbara Fawcett, of Cawsand, Devon.

GOLDSMITH—OLIVER.—On Sept. 9th, at Wood Green Congregational Church, Edward J. Goldsmith, M.R.C.S. Eng., of Allestree, near Derby, to Ivy E. Oliver, M.R.C.S. Eng., of Wood Green, London.

GURNEY—MOULE.—On Sept. 10th, at St. Peter's Church, Limpsfield, Theodore Ronald Valpy Gurney, M.B. Brist., to Agnes Mary Riddell, only daughter of Mr. and Mrs. W. Moule, of Brighton.

HOLGATE—GAMON.—On Sept. 11th, at Halton, Albert William Holgate, M.S. Lond., F.R.C.S. Eng., of Chester, to Monica Taylor Gamon, of Halton, Cheshire.

MARSHALL—DE MIERRE.—On Sept. 10th, at Hellingly Parish Church, Sussex, George Hay Marshall, F.R.C.S. Edin., to Helen Mary (Jill), second daughter of Mr. A. De Mierre, of Hellingly.

MATTHEW—COUND.—On Sept. 7th, at St. Theodore's Church, Port Talbot, Patrick Crichton Matthew, M.R.C.S. Eng., to Catherine, youngest daughter of the late Mr. Alfred Cound and Mrs. Cound, Port Talbot.

GOLDEN WEDDING

FORTESCUE FOX—MCDOUGALL.—On Sept. 16th, 1885, at the Jameston Church, Strathpeffer, by the Rev. James Calder McPhail, D.D., Pilrig, Edinburgh, Robert Fortescue Fox, M.D., seventh son of Joseph John Fox, Surgeon, of Stoke Newington, to Katharine Stewart McDougall, daughter of the Rev. W. S. McDougall, Strathpeffer.

DEATHS

DUNCAN.—On Sept. 15th, at Afton, Woking, William Duncan, O.B.E., M.B. Glasg., a senior medical officer of the Ministry of Health.

EDGINTON.—On Sept. 12th, at Walton St. Mary, Clevedon, Somerset, Robert William Edginton, M.D. Brux., M.R.C.S. Eng., aged 85.

MACBEAN ROSS.—On Sept. 16th, at Portsmouth, Donald Charles, dearly beloved elder son of Doctor and Mrs. J. N. MacBean Ross, of Lauriston, Sutton, Surrey.

MCMASTER.—On Sept. 8th, suddenly, at 7, Forestdale, Southgate, London, N.10, Archibald Cotterell McMaster, M.D., F.R.C.S. Edin., late of Rugby.

RICHARDS.—On Sept. 12th, suddenly, at Odiham, Hants, Robert Richards, L.R.C.P.I., L.R.C.S. Edin., aged 72.

WINSLOW.—On Sept. 8th, at North Stoke Mill, Oxford, Walter Winslow, M.B., B.Chir. Camb.

WORTHINGTON.—On Sept. 14th, at Warwick, Sidney Worthington, M.D. Lond., F.R.C.S. Eng., aged 76 years.

N.B.—A fee of 7s. 6d. is charged for the insertion of Notices of Births, Marriages, and Deaths.

NOTES, COMMENTS, AND ABSTRACTS

A PROPOSED NATIONAL OXYGEN TENT SERVICE

THE British Red Cross Society has received the following memorandum from members of the staff of all the London teaching hospitals:—

"We who have signed this letter are convinced that the oxygen tent provides the most efficient means of administering oxygen so far devised, and is of great value in a number of medical and surgical conditions. We should welcome any steps to make the method more readily available in hospitals and in the patient's own home. We believe that any help the British Red Cross Society can give in this connexion will be for the public welfare."

The signatories to this memorandum are Lord Dawson of Penn (London), Lord Horder and Sir Thomas Dunhill (St. Bartholomew's), G. E. Beaumont and R. A. Young (Middlesex), A. Tudor Edwards (Westminster), Douglas Firth (King's College Hospital), Francis R. Fraser (Postgraduate Medical School, Hammersmith Hospital), Reginald Hilton (St. Thomas's), Gordon Holmes (Charing Cross), Arthur F. Hurst and E. P. Poulton (Guy's), Cecil A. Joll (Royal Free), Reginald Miller (St. Mary's), Wilfred J. Pearson (University College Hospital), and James Torrens (St. George's).

The British Red Cross Society has decided to respond to this memorandum by coöperating in the establishment of a national oxygen tent service should it be found that there is need for such a service. Before embarking on a complete scheme, which would involve considerable expense, the society desires to collect more definite data than is at present available on the value of the apparatus in various conditions. In order to obtain this evidence the society has placed an order for the construction of twelve sets of apparatus, which will probably be completed before the end of October. One tent will then be placed at the disposal of each of the hospitals to which the signatories to the memorandum are attached (except the Hammersmith Hospital which already has one), the initial cost being met out of the funds of the society.

The hospitals have been asked whether they are willing to accept one of the tents for trial over a period of not less than two months, keeping comprehensive records of the cases for which it has been used, and furnishing a report at the end of the period on the value and desirability of a national service. If at the end of the trial any hospital wishes to acquire the apparatus it can do so on refunding the cost of the tent to the society.

As some instruction is desirable as to the operation of the apparatus, a model will be at the house of the British Red Cross Society, 14, Grosvenor-crescent, London, S.W.1, and will be available for demonstration to members of the staff of the hospitals by appointment after Oct. 1st.

The bed tent for administering oxygen and carbon dioxide, described by Dr. E. P. Poulton and illustrated in our columns two years ago (see THE LANCET, 1933, i., 245), has since been modified in important details. It has been found possible to abandon the cumbersome extension ladders on either side of the bed, with the crossbar from which the tent was suspended. The modern tent is built on an adaptable frame and can be raised or lowered by means of a handle behind the bed. The provisions for keeping the patient under full observation through non-inflammable celluloid windows, and for keeping him dry and cool, have also been improved. It seems likely that the hospitals concerned will gratefully accept the offer of the British Red Cross Society. If the verdict is favourable, the next step may be the organisation of a hire service for oxygen tents under the auspices of the society.

REGIUS CHAIR OF PHYSIC AT CAMBRIDGE

A CORRESPONDENT writes: "Your note on the appointment as the twenty-first regius professor of physic at Cambridge of Dr. John Ryle, physician to Guy's Hospital, raises some points of interest. The chair was founded in 1540, and until 1892, when Sir Clifford Allbutt was appointed, had almost always been occupied by a local physician resident in Cambridge. Before Allbutt's appointment, Sir Andrew Clark, then president of the Royal College of Physicians of London and also of the Royal Medical and Chirurgical Society, was asked by some members of the medical faculty at Cambridge if he would accept the chair, but he declined. So although Dr. Ryle is the first regius professor not a Cambridge man by education, the idea of introducing such entirely fresh blood is more than forty years old. Under the new statutes all Cambridge professors appointed after Oct. 1st, 1924, vacate their office and automatically become Emeritus professors at the end of the academic year in which they attain the age of 65 years. Before this change was instituted by the Royal Commission, the only limit was that of life, and 5 of the 18 professors of physic under the old statutes remained in office when 80 or more years had passed over their heads; one indeed was 90, and Sir Clifford Allbutt, who never grew old in mind, was 89 years of age. Two professors with tenures of 52 and 41 years practically monopolised the whole of the eighteenth century.

"On the other hand, two others—the second, John Hatcher, and the ninth, Ralph Winterton—held the chair for one year only. It was he who as a mathematician had suffered from sleeplessness and melancholia and consulted the then regius professor of physic, Dr. John Collins; this professor advised him to give up mathematics and to study medicine, assuring him that he might thus erase from his mind the recollection of past ills. 'I did,' said Winterton in the preface to one of his books, 'as he advised, and what he foretold took place.' Winterton was a most eminent scholar, but unfortunately died in his thirty-seventh year in 1636. His successor was far the most distinguished occupant of the chair before the nineteenth century—namely, Francis Glisson, anatomist, physiologist, pathologist, physician, pioneer in orthopædics, and philosopher. He was in the regius chair for the remaining 31 years of his life, but was much of an absentee first during the Civil War when he practised at Colchester with great success, and also, but especially later, in London where he held many offices, including that of president, at the Royal College of Physicians, was one of the original Fellows of the Royal Society, and did yeoman's service during the great plague. He probably also found the intensely Royalist atmosphere at Cambridge distasteful. Caius, his senior, was also president of the college, but not regius professor; both of them died in London.

"The posts of regius professor of physic and that of regius professor of medicine at the senior university are high in honour, ranking next to the usually more temporary presidents of the two Royal Colleges. It is fortunate to be able to fill such a post under the new conditions with one who is in every way eligible and is also young enough to have the prospect of holding it for a considerable period. With its popular medical school of 500 students engaged in pre-clinical work under the best possible conditions, the possibility of the Cambridge School ever becoming 'complete'—namely, supplying clinical facilities of a satisfactory character to all these students—is more remote than ever from practical politics. Half a century ago teachers in all the clinical subjects were appointed, and the ambitious plan of a complete medical school was more than a dream at any rate to the first-named of the great triumvirate—Sir George Humphry, Sir George Paget, and Sir Michael

Foster—to whom the medical school is so largely indebted for its present efficiency and fame.

"Cambridge is the home of research, and realisation of the need for an adequate department there of clinical science with facilities for research is not new; Oxford has been more fortunate in being able to set this example to the younger university. The advantages of a scheme whereby young medical graduates could carry out investigation on clinical problems in selected cases under the guidance of an active director and in close touch with the fine laboratories of anatomy, physiology, biochemistry, and pathology are too obvious to justify more argument; but there is thus an opportunity for a well-advised benefactor to set going a department which should fully show the great value of such generosity.

"The new regius professor is imbued with the traditions of Guy's Hospital, and the example of Addison, Bright, and Hodgkin and many others; indeed it is perhaps remarkable, and certainly a propitious omen, that there is now for the first time this link between that great hospital and the Cambridge medical school."

SOME HOSPITAL PHARMACOPŒIAS

THE introduction of the B.P. 1932 has necessitated the revision of many hospital pharmacopœias and other publications concerned chiefly with official drugs. Three such pharmacopœias are those of King's College, St. Mary's, and Westminster Hospitals, all of which have been brought up to date and issued as 1934 editions. There are many features in common and numerous familiar formulæ are included in each, but it is interesting to note certain individual tastes in prescribing.

At King's there is a cataplasma carbonis, consisting of crushed linseed and wood charcoal; morphine acetate, a relatively unstable salt of morphine, is retained in *Collut. Morphinæ;* ergotamine tartrate is prescribed as an injection which is given the name of *Injectio Ergotæ;* chiretta is used as the bitter in *Mist. Acid. Hydrochlor.;* Unna's paste contains 2 per cent. of ichthammol; pills are featured and only two formulæ for tablets are given.

At St. Mary's we find *Gutt. Duboisin. Sulphat., Inj. Lithii Salicyl.* for varicose veins and, although liquid extract of ergot, B.P. 1932, gives an unsightly deposit on admixture with water, formulæ are given for *Mist. Ergot. Acid.* and *Mist. Ergot. Alk.* Chloramine T is used in the preparation of *Inj. Chloraminæ*, a preparation much superior to the hypochlorite solutions on account of its stability. In the list of proprietary preparations two mistakes call for comment. Radiostoleum (it should be Radiostol) is given as the synonym for *Liq. Ergosterol. Irradiat.*, and a more serious mistake is Medinal for soluble phenobarbitone, instead of soluble barbitone.

Westminster has a number of medicated papers—e.g., *Charta Potass. Nitrat. Enema Rutæ* is retained and an unusual mixture in the children's formulary is *Mist. Ichthammolis.* This pharmacopœia shows evidence of improved formulæ in the introduction of elix. cascaræ in *Mist. Casc. Sagr.*, the use of light liquid paraffin in the preparation of nebulæ, and physostigmine salicylate in *Gutt. Physostigm.*

All three of these hospital pharmacopœias contain data and tables of value to the hospital student and the practitioner.

CHILD DEVELOPMENT

AN ambitious attempt to portray the development of the child from its earliest infancy to full adult growth which, she assumes, is reached at the early age of 17 years, has recently been published by Prof. Charlotte Bühler.[1] She has tried by means of direct observation and experiment to evaluate the development of traits in the intellectual, emotional, and social spheres. We have every sympathy with the desire to obtain more definite estimates of the normal evolution of children, while hesitating to accept any estimate based on such figures as are here presented. The collection of cases from which conclusions are drawn is inadequate and the generalisations made do not bear scrutiny. Dr. Bühler does not give all the figures on which she bases her statements; but we quote two which she does mention to show how narrow is the viewpoint from which she has worked. The first is the estimate of the reactions of very young infants: "the cross-section was arrived at by studying five healthy children for each month of the first year for one day and one night." At the other end of the scale her estimate of the characterological constants of children is based on a study of only 20 families, and by means of the visits of a psychologist to a family twice a week for one to two hours, with a subsequent "write up" of impressions, it being tacitly assumed that the reactions of the family were normal in the presence of the guest. Dr. Bühler apparently has little use for the psychological tests accepted in this country, the revised Terman, the Binet-Simon, the Merrill-Palmer, the Gesell tests, because they are designed to test only intellectual ability. This is certainly not true of the Gesell and Merrill-Palmer tests, and in any case if Dr. Bühler had studied some of the psychological reports submitted in the child guidance clinics in this country she would have found the formal report of the estimated I.Q. almost invariably accompanied by a comment on those emotional and social reactions of the child which might modify the intelligence estimate. Incidentally all the accepted tests are based on groups of more than 600 cases, and have been revised and adapted to fit the particular types of children for whom they are used, so that inaccuracies dependent on such factors as race or environment may be eliminated. Apart from the unsatisfactory figures on which the conclusions are based, some of the experiments described by Dr. Bühler are open to objection in themselves. To test a child's social responses and body control at the age of 6 months by making an "angry expression" at it to see if it will react, or by covering its head with a diaper to see if it will remove it, are measures which one would expect to produce not normal but rather fear reactions. There are other features of the book which detract from its value as a serious contribution to the study of child psychology.

Dr. Susan Isaacs's pamphlet [2] belongs to an entirely different category. In it she sets out clearly the broad lines of child development, laying stress on the number of aspects from which it needs to be studied if satisfactory conclusions are to be drawn. While insisting on the importance of the biological background, she claims with justice that any attempt to understand the development of the human child in terms of crude biological returns which overlook his early social relations is quite misleading. Dr. Isaacs's little book should be of value not only to the child psychologist but also to teachers and other educational workers. An interesting feature is her reference to the importance of affective influences in deflecting the whole course of intellectual development and the possibility of psychotic mechanisms producing the appearance of mental defect. Of especial value, too, is the exposition of the stages of maturation of intelligence and the phases of development at which children learn most easily things intellectual and practical. The psychologist will find useful the summary of the methods by which Dr. Isaacs considers psychological data can best be collected: observation, incidental and experimental; experiment, including direct measurement of simple functions and intelligence tests; developmental

[1] From Birth to Maturity. By Charlotte Bühler, Professor at the University of Vienna. London: Kegan Paul, Trench, Trübner and Co., Ltd. 1935. Pp. 237. 7s 6d.

[2] The Psychological Aspects of Child Development. By Susan Isaacs, M.A., D.Sc., Head of Department of Child Development, University of London Institute of Education; Psychologist to the London Clinic of Psycho-analysis. London: Evans Brothers Ltd. 1935. Pp. 45. 1s. 6d.

schedules of age-groups; and psycho-analysis of children. Throughout, the point of view is objective. The pamphlet is intended as a basis of study; it is accompanied by a useful little bibliography and contains unbiased accounts of a wide variety of methods. In the more detailed description of normal and abnormal traits which follows, a brief description of each is given, with the ages at which it most commonly occurs. All this is very suggestive and is allowed to remain so, no attempt being made to regard hypotheses as scientifically tested facts or to base statistics on a small number of cases. The pamphlet concludes with a plea for skilled and sympathetic workers in education and psychology.

DOCTORS, CHEMISTS, AND POPULATION.—The *Pharmaceutical Journal* of Sept. 7th has taken the trouble to work out the proportion of pharmacists and doctors to population in this country. The years chosen are those of the decennial census and the area chosen is not quite the same in the two groups, being Great Britain for the pharmacists and the British Isles for the doctors.

Year.	Pharmacist.	Doctor.
1911	2495	1109
1921	2307	1038
1931	2053	881

HYGIENIC CAPS FOR MILK BOTTLES.—The metal cap now being used by United Dairies Ltd. for its milk bottles completely covers the pouring edge of the bottle. In the old type of bottle sealed with a pasteboard disc it was possible for dirt to collect on the disc and on the pouring edge of the bottle. The new cap eliminates this risk, and has the further advantage that it can be replaced as a cover after the bottle has been opened.

THE "Annual Review of Biochemistry," mentioned on p. 617 of our last issue, can be obtained from Messrs. H. K. Lewis and Co., Ltd., for 22*s.* 6*d.*

Appointments

ALLEN, GEOFFREY, M.B., has been appointed Hon. Pathologist to the South-Eastern Hospital for Children, London.
BANNERMAN, R. G., M.D. Edin., Non-resident Pathologist to the Peterborough and District Memorial Hospital.
DUNN, B. VENN, M.D., F.R.C.S. Edin., Hon. Surgeon in charge of Out-patients to the Torbay Hospital, Torquay.
FORBES, JEAN, M.B., Junior Resident Medical Officer at the Manchester Babies' Hospital.
GROSS, D. M. B., M.D. Leeds, D.P.H., Assistant Medical Officer of Health, Ilford.
WEIR, J. H., M.D. Durh., B. Hy., D.P.H., Assistant Medical Officer of Health, Ilford.
WILSON, W. ETHERINGTON, F.R.C.S. Eng., Hon. Surgeon to the Torbay Hospital, Torquay.
WRIGHT, A. B. B., M.B. Glasg., Senior Resident Medical Officer at the Manchester Babies' Hospital.

Vacancies

For further information refer to the advertisement columns

Aberdeen Royal Hospital for Sick Children.—Hon. Asst. Surgeon to Ear, Nose, and Throat Dept.
Aberdeen Royal Infirmary.—Hon. Jun. Asst. Surgeon to Ear, Nose, and Throat Dept.
Altrincham General Hospital.—Sen. and Jun. H.S.'s. £150 and £120 respectively.
Barbados General Hospital.—Jun. Res. Surgeon. £325.
Birmingham City.—Asst. M.O. £550.
Birmingham, West Heath Sanatorium.—Res. Asst. M.O. At rate of £250.
Birmingham and Midland Eye Hospital.—H.S. At rate of £130.
Bolton Royal Infirmary.—H.S. £125.
Bradford Royal Eye and Ear Hospital.—H.S. £160.
Brighton, Royal Sussex County Hospital.—H.S. £150.
Central Middlesex County Hospital.—Med. Supt. £1300.
Chelmsford and Essex Hospital.—H.P. and H.S. Each at rate of £150.
Chester County Mental Hospital.—Jun. Asst. M.O. £350.
Coventry and Warwickshire Hospital.—Res. H.S. Also Cas. O. Each £125.
Derbyshire County Sanatorium.—Jun. Res. Asst. M.O. £350.
Eastbourne, Princess Alice Memorial Hospital.—Res. H.S. £150.
East Ham Memorial Hospital, Shrewsbury-road, E.—H.S. to Spec. Depts. and Cas. O. At rate of £120.
Elizabeth Garrett Anderson Hospital, Euston-road, N.W.—Surg. Reg. £100.
Essex County Council, Public Assistance Dept.—District M.O. 11 gns. per week.
Evelina Hospital for Sick Children, Southwark, S.E.—H.P. At rate of £120.
Glasgow Corporation, Police Dept.—Physician to the Force. £1250.
Glasgow, Woodilee Mental Hospital, Lenzi.—Jun. Asst. M.O. £300.
Halifax Royal Infirmary.—Res. Surg. O. At rate of £250.
Hertford County Hospital.—H.S. At rate of £180.
Hospital for Consumption and Diseases of the Chest, Brompton, S.W.—Res. Surg. O. and Asst. Res. M.O. Each at rate of £150. Also H.P.'s. Each at rate of £50.
Hospital for Sick Children, Great Ormond-street, W.C.—Res. Med. Supt. £300. Asst. M.O. £300. Also Out-patient Med. Reg. £250.
Hospital of St. John and St. Elizabeth, 60, Grove End-road, N.W.—Res. H.S. At rate of £75.
Huddersfield Royal Infirmary.—H.S., H.P., and Res. Anæsthetist. Each at rate of £150.
Ipswich, East Suffolk and Ipswich Hospital.—Consulting Physician.
L.C.C.—Asst. M.O. for White Oak Hospital, Swanley. £350.
L.C.C.—Jun. M.O.'s. Each £7 a week.
Leicester Royal Infirmary.—Jun. Res. Anæsthetist. At rate of £150. Also Sen. Cas. O. £125.
Lincoln, Bracebridge Mental Hospital.—Jun. M.O. £350.
London Jewish Hospital, Stepney Green, E.—Second Hon. Asst. Ophth. Surgeon.
Maidstone, Kent County Mental Hospital.—Asst. M.O. £509.
Manchester, Ancoats Hospital.—H.S. for General and H.S. for Ear, Nose, and Throat Dept. At rate of £100.
Manor House Hospital, Golders Green, N.W.—Jun. M.O. £200.
Mansfield and District Hospital.—Hon. Ophth. Surgeon.
Mansfield, Harlow Wood Orthopædic Hospital.—Two H.S.'s. Each at rate of £200.
Margate and District General Hospital.—Res. M.O. £150.
Middlesbrough Education Committee.—Sen. Asst. School M.O. £500.
Middlesbrough, North Ormesby Hospital.—Hon. Orthopædic Surgeon.
Middlesbrough, North Riding Infirmary.—Third H.S. £125.
Nelson Hospital, Merton, S.W.—Res. H.S. At rate of £100.
New Zealand, University of Otago and Dunedin Hospital.—Sen. Res. M.O. £500.
North Riding of Yorkshire County Council, &c.—Two M.O.H.'s. Each £800.
Norwich, Jenny Lind Hospital for Children.—Res. M.O. £120.
Nottingham General Dispensary, Gregory Boulevard Branch.—Res. Surgeon. £250.
Nottingham General Hospital.—H.S. for Ear, Nose, and Throat Dept. At rate of £150.
Nottingham Hospital for Women.—H.S. At rate of £150.
Nottingham and Midland Eye Infirmary.—Hon. Asst. Surgeon.
Oldham Royal Infirmary.—Cas. O. and H.P. At rate of £175.
Paddington Green Children's Hospital, W.—H.P. and H.S. Each £150.
Queen Mary's Hospital for the East End, E.—Asst. Pathologist. £400.
Queen's Hospital for Children, Hackney-road, E.—H.P. and Cas. O. Each at rate of £100. Also Asst. Physician.
Richmond Royal Hospital.—Jun. H.S. At rate of £100.
Rochdale County Borough.—Jun. Res. M.O. for Birch Hill Hospital. At rate of £225.
Royal Eye Hospital, Med. School, St. George's-circus, S.E.—Research Scholarship. £100.
Royal Free Hospital, Gray's Inn-road, W.C.—Res. Anæsthetist Reg. £100. Also Res. Cas. O. At rate of £150.
Royal Masonic Hospital, Ravenscourt Park, W.—Res. Surg. O. At rate of £250.
Royal National Orthopædic Hospital, Great Portland-st., W.—Two Registrars Each £105.
St. Mary's Hospital, W.—Surg. Reg. £200. Also Obstet. Reg. and Jun. Clin. Asst. for X Ray Dept. Each £50.
St. Mary's Hospital for Women and Children, Plaistow, E.—Resident and Asst. Res. M.O.'s. At rate of £175 and £120 respectively.
Samaritan Free Hospital for Women, Marylebone-road, N.W.—H.S. At rate of £100.
Sheffield, Jessop Hospital for Women.—Two H.S.'s. Each at rate of £100. Also Hon. Surgeon.
Sheffield Royal Infirmary.—Clin. Asst. for Dermatological Dept. £300.
Southend Municipal Hospital.—Two Asst. M.O.'s. Each £275.
Southend-on-Sea General Hospital.—Pathologist. £600. H.S. £100. Also Hon. Visiting General Physician and Surgeon.
Swansea General and Eye Hospital.—H.P. Also H.S. Each at rate of £150.
Torquay, Torbay Hospital.—H.S. £175.
Wigan, Royal Albert Edward Infirmary, &c.—H.S. At rate of £150.

DURHAM COUNTY HOSPITAL.—This institution, to which almost all the miners contribute, is in need of considerable extension. Many more serious cases apply for admission than can be accommodated. The out-patients' department is also badly overcrowded. Last year the expenditure of the hospital exceeded its income by over £2000.